

AN ANALYSIS OF TOTAL ACQUISITION LEAD  
TIME FOR SMALL PURCHASE ACTIONS IN  
AN OPERATIONAL CONTRACTING ENVIRONMENT

THESIS

Lee R. Kair, Captain, USAF

AFIT/GCM/LAS/96S-3

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DEPARTMENT OF THE AIR FORCE  
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FOR SMALL PURCHASE ACTIONS IN AN OPERATIONAL  
CONTRACTING ENVIRONMENT

THESIS

Presented to the Faculty of the Graduate School of

Logistics and Acquisition Management

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In Partial Fulfillment of the

Requirements for the Degree of

Master of Science in Contracting Management

Lee R. Kair, B.S.M.E.

Captain, USAF

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Lee R. Kair

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Abstract

This research was performed for the purpose of determining the factors which affect Total Acquisition Lead Time (TALT) for small purchase actions procured in an Operational Contracting Environment. The literature review develops a theoretical model using factors such as socio-economic program, regulatory requirements, alternate means of procurement, buyable purchase requests, customer access to information, funding issues, management information systems, purchase of off-the-shelf items, and accelerated or reduced coordinations.

A variety of statistical techniques, including a qualitative regression, Bonferroni Technique, descriptive statistics, and parsing of TALT are used to determine the significance and impact of these factors on TALT. The results of this study indicate that many of these factors, including buyable purchase requests, funding issues, management information system, accelerate or reduced coordinations, and the use of socio-economic programs are significant on TALT. Parsing of TALT is shown so that each step and the corresponding times are shown for each phase in small purchase contracting. A wide sample was used, pulling from 5 different United States Air Force Bases.



# AN ANALYSIS OF TOTAL ACQUISITION LEAD TIME FOR SMALL PURCHASE ACTIONS IN AN OPERATIONAL CONTRACTING ENVIRONMENT

## 1: Background and Statement of the Problem

### Introduction

United States Air Force operational contracting squadrons are responsible for contracting for supplies, services and construction in support of the operation of United States Air Force Bases. These items are typically of relatively low dollar amount, but high volume. The vast majority of the items purchased are below the small purchase threshold as defined by the Federal Acquisition Regulation (FAR). This threshold is now at \$50,000 unless electronic contracting is utilized where the threshold is \$100,000 (FAR 13.105). This increased threshold will allow for higher dollar procurements using simplified techniques.

The organizations which deal with acquisition, including contracting, accounting and finance, base supply, medical supply, Government Operated Civil Engineering Service Store (GOCESS) or Contractor Operated Civil Engineering Service Store (COCESS), and the user (AF Form 9 Preparation Guide, undated:9), have made great strides in the last 20 years to utilize computer technology to decrease the workload on people and procure items expediently. These improvements were, unfortunately, not implemented with proper interface or cohesion between the systems since they were developed on

different platforms, using different operating systems, and met different requirements. To compound the problem, the regulations which have been promulgated by each of the different organizations often are not consistent or user friendly. The inconsistencies between the different organizations have created a procurement system which can be time consuming and confusing to users. The users must have the items they require at approximately the time they indicate on the purchase request in order to keep their units functioning properly. When bureaucratic problems create delays, missions can suffer.

This thesis will study the reasons for long lead times in an operational contracting environment. The means for the study will be to develop a theoretical model for efficient procurement, and to study the factors in the model which are believed to have impact on Total Acquisition Lead Time (TALT), or the time from purchase request inception to delivery of an item. Once these factors are studied, an in-depth analysis of each part of the procurement process will be undertaken to determine the causes of long TALT.

### Background

The major players in the operational contracting field are the following: Base Supply, Medical Supply, Government Operated Civil Engineering Service Store/Contractor Operated Civil Engineering Store (GOCESS/COCESS), Accounting and Finance, the user, and the Operational Contracting Squadron or Division (AF Form 9 Preparation Guide, undated:2). The process flow for each

of these players is different, but they all have the same problems in terms of long lead times.

There have been a few notable attempts at using recent technology to solve office process problems. In the contracting community they include: Government Acquisition Through Electronic Commerce (GATEC) at Wright Patterson AFB, Base Contracting Automated System (BCAS) Image Capability Enhancement Program (BICEP) at Patrick AFB and Brooks AFB, and the EDEX project at Edwards AFB. For the accounting and finance community, the newest solution is Financial Electronic Document Server (FEDS). All of these systems will be explained in greater detail in Chapter 2, however, they all suffer from the same problems. Even though some of these programs run on open systems, all of these programs are still reliant on other aging and proprietary platforms to work properly.

One of the largest problems in the procurement process is the bureaucratic process flow in the form of coordination points, according to Beth Wann, Chief of the Commodities Branch at Brooks Air Force Base (Wann telephone interview, 20 March, 1996). The coordination points vary with each type of procurement, stock class, and individual item. There are often a variety of coordination points for a single item (AF Form 9 Preparation Guide, undated:2). As an example, to purchase a "golf cart" or "Mule" for people to travel around base, the following coordinations are necessary:

1. The user creates the purchase request.
2. The user gets coordination from the supervisor.

3. The user gets coordination from the resource manager.
4. The purchase request (PR) and a letter by the user to explain the need for the item, and why the base taxi or base shuttle is not sufficient, are sent to Transportation for coordination.
5. The PR is sent to Civil Engineering for coordination because CE is the Point of Contact (POC) for Mules.
6. The PR is sent to Safety for coordination and acceptance of a separately developed safety plan and Operating Instruction for the operation of the Mule.
7. The PR is taken to Base Supply where it is put into the Base Supply system (SB/SS).
8. The PR is transferred to Operational Contracting for local purchase.

This means 8 separate coordination points are necessary before the item is advertised to the local community for purchase of an item which costs less than \$5,000.00.

The process of moving the PR between points is often time consuming in itself. The user is sometimes forced to hand carry the purchase request to each of the coordination points to avoid the paperwork being lost or requiring an inordinate amount of time. The hand carrying process is known as a "walk through" and is meant to only be used in cases of emergencies or high priority items (AF Form 9 Preparation Guide, undated:4). Walk throughs require each person in the process to stop what they are doing to process the request. The

loss of productivity to the user and each person in the coordination process is difficult to quantify because each purchase request is handled differently and "as a favor". The time between purchase request inception and the time of delivery (TALT) is usually between 30 to 120 days, even when items are "walked through" (AF Form 9 Preparation Guide, undated:4).

The internal process coordination between different organizations on a base is not defined in regulation, and is often set by iterations of various managers at the local level. With the relatively constant change in personnel at a base, the attitude is often to use the status quo without regard for the reason. The personnel in each organization are not aware of the internal processes of the other organizations on the same base.

From the previous example, it is apparent that there is a specific process which is required to purchase the item. This process flow can be studied in greater detail to determine which portions of the process can be altered or deleted if they are not necessary, or if they can be accelerated through technology. The process flow, in this case, is from the time that the purchase request was first created to the time that the "Mule" was delivered. Any reduction or positive restructuring of the process flow, would have a corresponding reduction in the TALT.

## Research Questions

In an attempt to study an efficient procurement system, an efficient procurement model needs to be created. Each factor of the model was selected based on the potential impact of the customers' perception of efficient procurement and is determined through the literature review.

Q1. What impact does the use of socio-economic programs have on TALT.

The Government has used socio-economic programs to further its socio-economic goals. It is estimated that between 15 and 30% of the Department of Defense budget is used to attain these goals (Gansler, 1989:151). This question is designed to study the impact of using these socio-economic programs on the speed of the procurement process.

Q2: How do regulatory requirements affect TALT?

Federal Procurement is controlled at every level by regulation and statutory laws. Recent studies have indicated that the cost of all of the regulation has added 30 to 50% to the cost of Federal procurement when compared to commercial procurement (Acquisition Law, 1993:16). This question is designed to study the time impacts of regulation on the procurement process.

Q3. How do alternate means of procurement impact TALT?

There have been many initiatives which attempt to decentralize procurement to the user, and automate procurement. These initiatives include

the International Merchants Purchase Authorization Card (IMPAC), decentralized Blanket Purchase Agreements (BPA's), Imprest Funds, and Electronic Commerce/Electronic Data Interchange (EC/EDI). This question will only study the speed impact of the last of these initiatives, EC/EDI on the total acquisition process.

Q4. What is the impact of the contracting office receiving purchase requests which are not adequate for purchase?

The contracting office often receives purchase requests which are not ready for procurement. When this occurs, the contracting personnel suspense the item back to the user for additional information. A suspense can also occur when contracting does not get enough information from the vendor to process the vendor's quotation. This question will study the impact of suspenses on the total procurement speed.

Q5. How does automated access to information affect TALT?

One of the Management Information Systems (MIS)'s allows access to information by the end user. This system is the Base Contracting Automated System Image Capability Enhancement Program (BICEP). This allows the users to check on status of the procurement from their desktop. This question is designed to study the impact of this access on the total procurement speed.

Q6. How does funding impact TALT?

There are many issues related to funding that can impact TALT. These issues include end of fiscal year rush, certification of funds, appropriation of funds, and "color of money" or the appropriation type. This question will study the impact of the certification of funds on the procurement speed, specifically, the amount of time which Accounting and Finance takes to process the certification of funds.

Q7. How do different Management Information Systems (MIS) affect TALT?

There are four main Management Information Systems that are studied, Base Automated Contracting System (BCAS), BCAS Image Capability Enhancement Program (BICEP), Menu Aided Data Entry System (MADES II), and Government Acquisition Through Electronic Commerce (GATEC). BCAS is the only system which is currently in place at all operational contracting sites in the Air Force. MADES II is in the process of being implemented Air Force wide and is the current Electronic Data Interchange (EDI) implementation solution for the Air Force. BICEP in its original form is only located at Patrick Air Force Base, and the later version, BICEP II is currently only in place at Brooks Air Force Base. Throughout this study, BICEP II is referred to as BICEP, unless otherwise noted. GATEC is currently only in place at Wright Patterson Air Force Base.

This question is related to alternate means of procurement because EDI uses an MIS to accomplish its tasks. This question is designed to look at the



differences due to speed of the MIS or process flows created by employment of the MIS. The purpose of this question is to determine the impact of these MIS's on the speed of the procurement process.

Q8. How do accelerated or reduced coordinations affect TALT.

As is described in the "Mule" example earlier in this chapter, there are often many coordinations which are necessary when processing a purchase request. In many cases, these coordinations take a different route than the prescribed processing to facilitate quicker processing. The purpose of this question is to determine if the different routing of purchase requests through coordination points affects the processing time of purchase requests.

### Scope and Limitations

The scope of this thesis is the process from purchase request inception (when the purchase request is created) to delivery of the item. It is limited to operational contracting divisions in the Air Force and for actions under the small purchase threshold.

The thesis is limited to TALT. Ultimately all of the factors in the Efficient Procurement Model must be met in order for efficient procurement to take place, however users must have the item which they request in a timely manner if they are going to be able to meet their office's mission. To quantitatively look at each part of the Efficient Procurement Model would be too large of an undertaking. Therefore, only those factors which relate to TALT are studied in this thesis.

Four different bases are utilized as samples for this study. Since these bases cross different commands, support missions, boundaries for base sizes, and utilize different internal local initiatives, there is no reason to believe that these bases would not be representative of the Air Force on the whole. For a more detailed analysis of the representation of the sample, see Chapter 3.

Purchase size is limited to items under the small purchase threshold. Items in this size category make up the vast majority of all items procured in the Government and the procedure used to procure these items is very methodically delineated and structured. The process analysis would be very different for large dollar purchases. Considerations such as differences in procurement technique, contract type, level of contractual approvals, coordination levels for funding and other regulatory requirements for large dollar procurements would need to be accounted for in large dollar procurements, which would make the quantitative analysis too large in scope.

## Plan for the Thesis

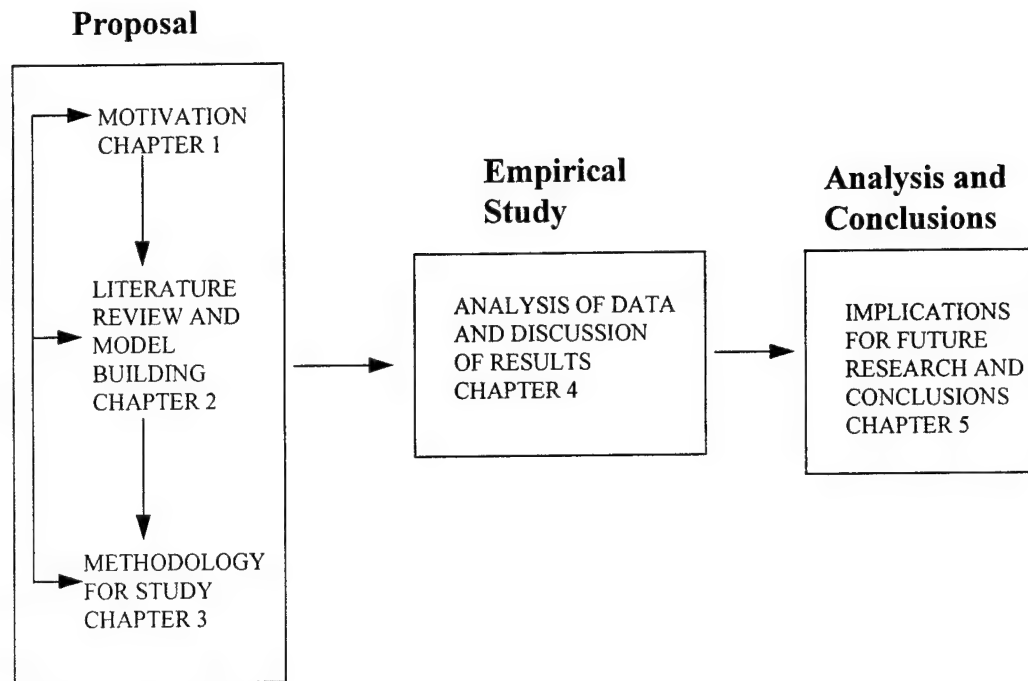


Figure 1-1. Plan for Thesis

Part 1: The Proposal. This thesis is broken into 3 parts. The first part is the proposal which gives an outline for the study. The first chapter in the proposal gives the motivation for the research, broad overview of the problem, a glossary of terms, and the scope and limitations of the research. The second chapter provides a review of the literature, the model to be used for study, and the theoretical basis for the study from which the conceptual model is formed. The third chapter describes the methodology and operationalizes the key variables.

As shown in the figure, the proposal process is an iterative process where the literature review redefines the research and the method of analysis.

Part 2: Analysis and Discussion. This section contains the analysis of the data. A detailed description of the study results and a discussion of the findings are provided in Chapter 4. This chapter reports the statistical information and the general meaning of the results. This chapter will also try to explain unexpected results.

Part 3: Implications for future research and conclusions. The final section, and final chapter of the thesis, discusses the implications of the study. Further avenues of study for this study are discussed, and the conclusions place the findings of the study into theoretical context.

### Conclusion

This thesis will study the effects of various factors on the total time from purchase request inception to delivery of an end item (TALT). This research is important because it affects all operational contracting sites in the Air Force. The total acquisition lead time has been a concern of users and resource managers for some time, and efforts have been underway to decrease this time. At the conclusion of the research, it will be known if the factors studied have an impact on this time.

## 2: Literature Review

### Introduction

There is a great amount of literature on the subject of small purchases and on Total Acquisition Lead Time (TALT). In this chapter, a review of this literature is presented, and a theoretical model is created. Once this model is created, it can be tested in Chapters 3 and 4.

### The Federal Procurement System Overview

The Department of Defense purchases two separate types of items; major weapon systems and commercial, off-the-shelf items (Gansler, 1989:143). The major weapon systems are highly technical, high dollar items which are purchased in relatively small quantities. Commercial, off-the-shelf items, also referred to as "standard" items, are relatively low price with high price sensitivity and are purchased in large quantities. Actions under \$25,000 accounted for \$14 billion, or about 11% of the total dollars spent in defense procurement, but 98% of the total number of transactions (DoD, 21 March 1996: WWWEB).

This means that while the small purchases account for a relatively small amount of the defense budget, they account for the vast majority of the total transactions processed by defense procurement professionals. Another separation for defense procurement is between operations and maintenance (O&M) and other types of procurement which would include research and development, aircraft, missiles, military construction, and personnel. O&M support costs the Air Force

\$79.8 billion dollars in 1983, or 27.4% of the Air Force's total budget (United States Air Force Statistical Digest, 1993:C-27).

To understand the contracting system, one must first have a frame of reference. The Department of Defense procured approximately 132 billion dollars in 1995. Defense procurement has been decreasing over the last decade. The Figure 2-1 shows the amounts spent from 1951-1995 (DoD, 1996: WWWWeb).

# DEPARTMENT OF DEFENSE PROCUREMENT

(Dollars in Thousands)

Fiscal Year	Total Amount	DD350 Actions	DD350 Amount	DD1057 Actions	DD1057 Amount
1951	\$32,649,000				
1952	\$43,569,000				
1953	\$31,812,000				
1954	\$13,279,000				
1955	\$16,582,000				
1956	\$19,590,000				
1957	\$21,458,000				
1958	\$24,197,000				
1959	\$25,312,000				
1960	\$23,689,000				
1961	\$25,584,000				
1962	\$29,254,502				
1963	\$29,378,720				
1964	\$27,947,945		\$25,327,542		\$2,710,403
1965	\$27,196,136		\$24,330,689		\$2,865,447
1966 1/	\$38,559,435	208,393	\$35,078,711		\$3,480,724
1967	\$44,774,318	231,634	\$40,922,038		\$3,852,280
1968	\$44,038,716	215,069	\$40,606,228		\$3,432,488
1969	\$42,035,153	215,548	\$38,708,481		\$3,326,672
1970	\$36,002,140	188,027	\$32,898,359		\$3,103,781
1971	\$34,774,487	173,668	\$31,697,173		\$3,077,314
1972	\$38,661,641	188,017	\$35,415,362		\$3,246,279
1973	\$38,031,888	190,829	\$34,619,205		\$3,412,683
1974	\$40,699,877	202,852	\$37,017,677		\$3,682,200
1975	\$46,075,752	220,482	\$41,974,562		\$4,101,190
1976 2/	\$60,942,602	216,786	\$54,668,032		\$6,274,570
1977	\$55,571,616	244,548	\$50,384,917	10,075,593	\$5,186,699
1978	\$66,874,458	269,198	\$61,271,472		\$5,602,986
1979	\$69,348,065	293,683	\$63,252,114	10,591,486	\$5,095,951
1980	\$83,686,442	325,169	\$76,807,259	11,746,636	\$6,879,183
1981	\$105,222,886	365,622	\$97,388,528	12,380,331	\$7,834,358
1982	\$124,724,875	420,293	\$116,659,772	12,542,435	\$8,065,103
1983 3/	\$140,482,972	241,442	\$128,242,123	14,525,103	\$12,240,849
1984 4/	\$146,031,610	237,111	\$133,571,275	14,533,478	\$12,460,335
1985	\$163,725,360	252,276	\$150,674,308	14,247,657	\$13,051,052
1986	\$158,829,340	260,842	\$145,742,058	14,180,721	\$13,087,282
1987	\$156,507,586	259,901	\$142,482,308	15,047,108	\$14,025,278
1988 5/	\$151,352,713	251,062	\$137,049,236	14,500,124	\$14,303,477
1989	\$139,343,457	221,377	\$128,958,161	9,066,334	\$10,385,296
1990	\$144,672,506	237,269	\$130,758,093	12,998,802	\$13,914,413
1991	\$150,855,267	253,553	\$136,677,443	12,044,010	\$14,177,824
1992	\$136,296,711	236,248	\$121,437,966	11,851,077	\$14,858,744
1993	\$138,307,134	247,190	\$123,713,397	11,655,617	\$14,593,737
1994	\$132,219,300	237,614	\$118,114,086	10,978,949	\$14,105,214
1995	\$131,964,903	258,178	\$118,151,954	10,355,060	\$13,812,949

1/ This is the first year of the automated system, no tapes exist for prior years data.

2/ This tape includes FY 1976T (transition) records.

3/ DD350 reporting changed from \$10,000 to \$25,000.

4/ MASTER file contains DD1057 records beginning with FY 1984.

5/ Tapes for FY 1966 through FY 1990 are available from National Archives.

Figure 2-1. Defense Spending (1951-1995)

## The Model

To understand the factors which affect procurement, a model needs to be created. The center of the model contains efficient procurement, and the factors which impact procurement's efficiency surround it.

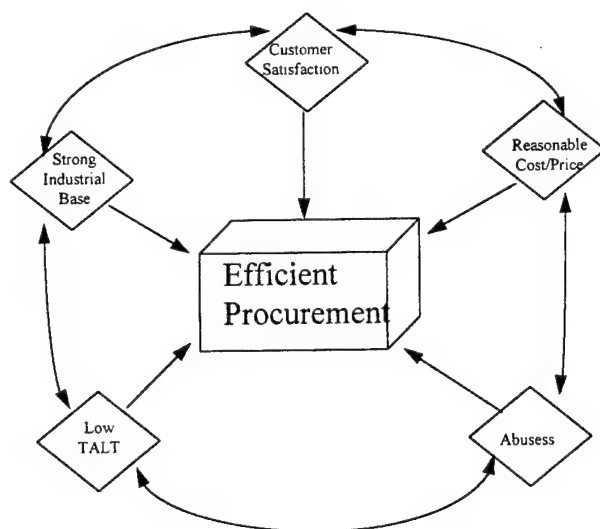


Figure 2-2. Efficient Procurement

The factors which affect to efficient procurement are the following:  
Customer satisfaction, a strong industrial base, abuses, reasonable cost or price and low TALT. These factors are based on a review of literature and reviews with experienced contracting supervisors.

Efficient Procurement. The definition for efficient procurement can be deduced from the Department of Defense "Mission of Acquisition Reform". Two of the elements of the mission show what the DoD believes to encompass efficient procurement. They are:

Be able to rapidly acquire commercial and other state-of-the-art products and technology, from reliable suppliers who utilize the latest manufacturing and management techniques

Be able to adopt business processes characteristic of world class customers and suppliers (including processes that encourage DoD's suppliers to do the same) ("Mission of Acq Reform", WWWWeb).



Stated simply, the definition of efficient procurement incorporates those factors which affect the ability to acquire the right product, at the right place, at the right time, and for the right price.

Customer Satisfaction. Ultimately the satisfaction of all of the customers is difficult to quantify because there is a variation in missions within the Air Force. Since the procurement process should be transparent to the end user, the customer satisfaction is generally based on the end result. If the correct item arrives in their office, at a reasonable price, at the correct time, and with little or no interaction between the end user and the contracting office, the customer is generally satisfied.

Interviews with contracting officers and program managers have revealed four major issues that are important for satisfaction:

1. satisfaction with the process
2. satisfaction with the speed of task completion
3. satisfaction with the product
4. satisfaction with the cost of the product (Vickery:1994, 50).

Part of satisfaction with the process stems from the flexibility with which an item can be procured. An efficient procurement model must be flexible enough to meet all of the customer's requirements. Flexibility is defined in this arena to be the ability to purchase any requirement utilizing different techniques including alternative procurement techniques, innovative contract type combinations, cooperative agreements, etc. The current system does apparently lend enough flexibility to almost all situations. We know this because we are

able to purchase almost any type of item, using a wide variety of techniques.

This flexibility does not necessarily equate to speed.

Flexibility can also affect the cost or price of the item because the method of procurement can have a drastic effect on the resulting price of the item. If methods of procurement are more flexible, a risk is incurred that the price may increase due to decreased competition.

Part of the satisfaction with the product stems from the acquisition of an *appropriate* end item. What is considered appropriate to the procurement activity may not be appropriate to the end user. This confusion lies in the fact that the FAR requires that only the minimum needs of the government are met (FAR 6.302-1). The customer will typically not be satisfied if he is not able to obtain the item which he feels that he requires. The reason for the substitution may be cost/price reasons, restricted competition reasons, or of the needs of the contracting officer to only procure the minimum needs of the Government (FAR 6.302-1).

Customer satisfaction is related to efficient procurement because it is the customer's perception which ultimately determines if the procurement process is efficient. It is the customer which sets the requirements, within limits, and decides if the item was correct, timely, and priced within their budgetary constraints.

Strong Industrial Base. The Defense Industrial Base (DIB) consists of industries which produce the military products required for the defense of the

country (Vickery, 1992:1). A strong defense industrial base for the United States is important for two reasons. The first reason is the federal government often attempts to promote its social agendas through its federal procurement policies. The attempts to use federal contracting as a means to stimulate economic growth has been utilized for centuries with some success, but at a cost of 15 to 30% of the DoD budget (Gansler, 1989:151). The second reason for a strong industrial base is the federal government needs the private sector to be available to sell its goods and services. If the policies of the government make it so that the private sector is not willing or able to sell to the government, the government would either be forced to produce its own goods or services, or not be able to complete many of its missions.

The implications for changes in the DIB are far reaching because they impact almost all of the factors in the Efficient Procurement Model. The decrease in availability of items and the resulting increase in cost/price of items can adversely affect customer satisfaction. This decrease in availability of items can also have an impact on the availability of the desired end-item. If the producer of a required item is pushed outside of the defense industrial base, that item is no longer available to those in the military. A reduction in the DIB reduces the flexibility of the procurement system because items are often no longer available at a reasonable price. An inherent function of government procurement is to increase the industrial base to increase competition. This increase will help to ensure that items are procured for a fair and reasonable price. If many sources are available to bid on items, the free market system can

work efficiently to establish the fair market value of items. Government regulations can have an adverse impact on the industrial base. When the Government imposes many restrictions on the contractor, the contractor is forced to either comply with the restrictions and pass the cost on to the Government or to leave the DIB. Finally, a reduced DIB impacts TALT because it takes contracting professionals longer to find civilian contractors which will do business with the Government, and this time increases the TALT.

Policies relating to the DIB are generally set into law by the United States Congress. For this reason, the effects of DIB on the efficient procurement model are factors which must be considered, but are not easily changed.

Abuses. There have been numerous television commentaries and newspaper articles about abuses in the federal procurement system. The American public's perception is that the system is corrupt. While it is obvious that abuses in the system are not acceptable, the number of abuses must be put into context. One must understand that with the 15 million separate contractual actions per year, even if the acquisition professionals were 99.99% perfect, it would commit over 1,500 errors (or "abuses" ) each year (Gansler, 1989:4).

It is obvious from these numbers that abuses would have a relatively small direct impact on the efficient procurement model. The large number of regulations required in federal procurement are, in many cases, as a result of previous abuses. Therefore, the impact of abuses on TALT can be measured through the impact of regulations on TALT.

Reasonable Cost/Price. The Contracting Officer is charged to only purchase items at a reasonable cost or price (FAR 15.805-1). This results in a dilemma because the contracting officer determines fair and reasonable price in the context of all of the regulations which he works under, while a user determines fair and reasonable in their own personal context and within their budgetary constraints. As is noted in the DIB section, there is a price to pay for the socio-economic programs which the Congress puts on the Executive branch. For this reason, reasonable price is related to customer satisfaction.

As was demonstrated in the discussion of the model; customer satisfaction, the industrial base, abuses, and cost/price all have an impact on efficient procurement. These factors are generally affected by process flows to a much lesser degree than TALT. These factors have their roots in legislation and with procurement of items above the small purchase threshold. The one factor in the Efficient Procurement Model which can be directly addressed by personnel at the operational level is TALT.

Low TALT. The focus of this thesis is to study one aspect of the efficient procurement model, the Total Acquisition Lead Time (TALT). TALT is defined as the amount of time from purchase request inception to the delivery of the item.

TALT is the only factor which can be directly addressed by management and personnel at the base level in operational contracting. TALT is also the over-riding factor for the end-user. In most cases, users are more interested in

getting the item quickly than cheaply, because the lack of the item has a much greater cost impact on them than any incremental savings that contracting could accomplish.

The idea of measuring TALT is not new to the Air Force. Offices such as the 65th CONS in the Azores have been measuring the time from purchase request receipt by contracting and delivery of the item and calling it TALT. This measurement has allowed them to give more realistic time frames to resource managers and to measure times which are more meaningful to commanders. The main problem is that there is no consistent way to measure true TALT, the time from PR inception to item delivery. These dates are either spread between 3 different systems or not available at all.

There are 9 factors which affect the TALT. The 9 factors were determined from a literature review and interviews with professionals in the procurement field. Figure 2-3 shows the expanded Efficient Procurement Model, and the factors which affect TALT.

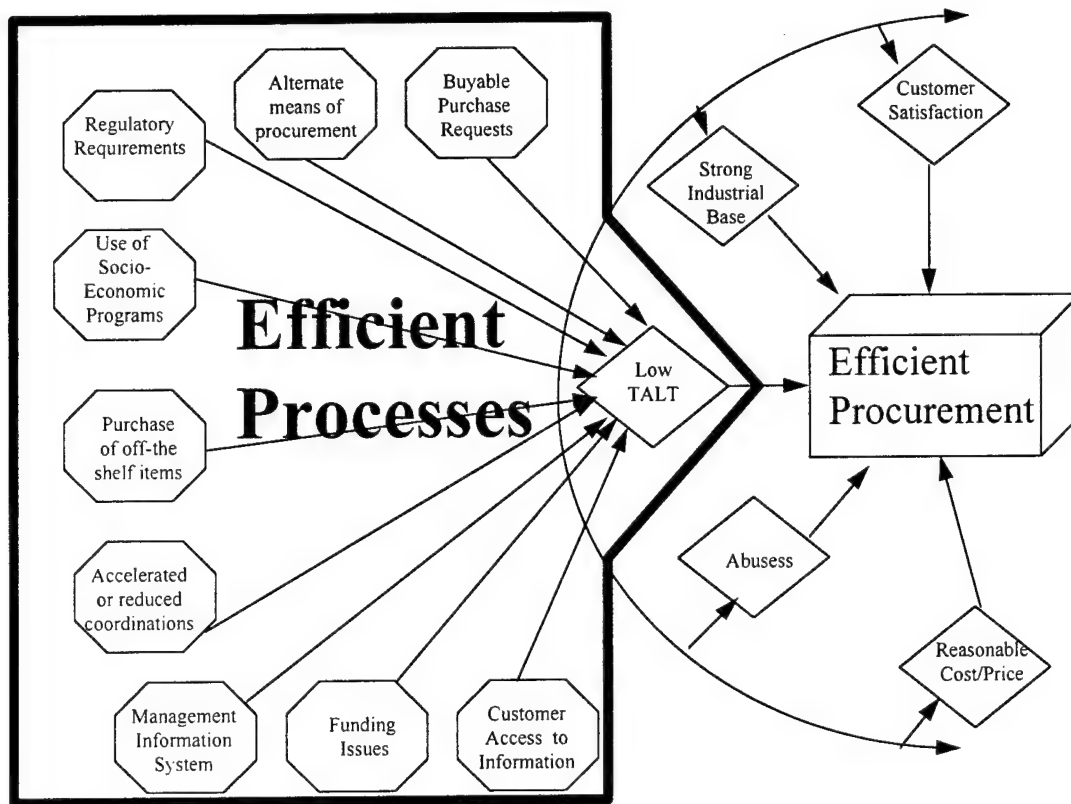


Figure 2-3. Expanded Efficient Procurement Model

A model altered to only show the factors relating to TALT looks like the following:

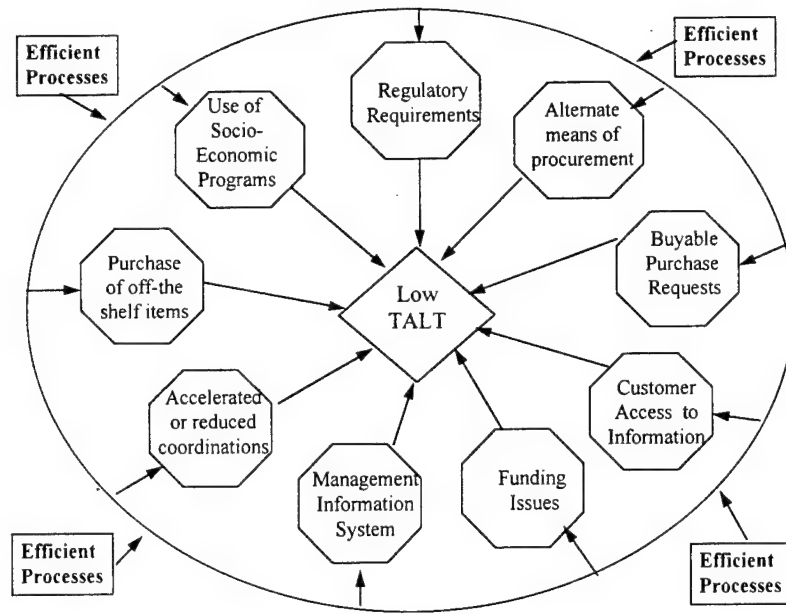


Figure 2-4. Factors Affecting TALT

These factors are:

1. use of socio-economic programs
2. regulatory requirements
3. alternate means of procurement
4. buyable purchase requests
5. customer access to information
6. funding issues
7. the management information system
8. accelerated or reduced coordinations
9. purchase of off-the shelf items.



As can be seen from the diagram, the factors which affect TALT are related to each other, just as the factors which affect efficient procurement are related. Efficient processes surround the factors which affect TALT, because it is through efficient processing of purchase requests that the other factors impact TALT.

Both the efficient procurement model and the model for TALT were based on current literature and have been validated by Colonel Lawrence, Head of Contracting at Brooks Air Force Base, Col Vasser, Division Chief of Request For Proposal Support Organization, Brooks Air Force Base, and Major Fossum, Program Director, Government Contract Administration, Air Force Institute of Technology. All of these contracting professionals have many years of contracting experience and are considered to be experts in the field.

Use of Socio-Economic Programs. One of the most significant differences between the public and private procurement systems is the Government's use of contracting to attain social or political objectives. The Small Business Act is a prime example of how the Government utilizes contracting in an attempt to help attain social and political goals. The annual cost of using contracting to attain these goals has been estimated to be 15 to 30% of the Department of Defense budget (Gansler, 1989:151).

The use of socio-economic programs is related to TALT due to increased restrictions on the buyer, the need for a more exhaustive solicitation of sources, and the corresponding reduction in the available base of vendors, all of which may impact the time required to purchase an item. Another effect of socio-

economic programs is on customer satisfaction, although this thesis will not study this effect. It is possible that the use of socio-economic programs may be related to customer satisfaction because of the increased price and increase in TALT.

Regulatory Requirements. The United States economic system is based on a free-market system, yet the defense market is, in reality, a totally regulated market where Congress, as a part of its "control over public funds" has been the instigator of most of the regulation (Gansler, 1989:151). The framers of the Constitution warned that

"the internal effects of a mutable policy are calamitous. It will be of little avail... if the laws [are] so voluminous that they cannot be read, or so incoherent that they cannot be understood; if they [are]... revised before they are promulgated, or undergo such incessant changes that no man who knows what the law is today can guess what it will be tomorrow...". (Gansler, 1989:151)

Even after this warning, by the mid 1980's, the Federal Acquisition Regulations (FAR) had reached 7,500 pages with over 30,000 pages of accompanying policy guidance (Gansler, 1989:151).

In a 1993 report of the Acquisition Law Advisory Panel to the United States Congress, the panel reported on regulatory reforms which are taking place and their impacts on the way in which the Government will procure items (Acquisition Law, 1993:I-4). The major thrust of the new legislation is for the Government to operate more efficiently with reduced budgets. The report states that the 70 billion dollars in reductions between 1990-1997 would come as a result of procuring items using improved business practices instead of cutting

result of procuring items using improved business practices instead of cutting programs. This report emphasizes the use of commercial practices and utilizing commercial, off the shelf items whenever possible, as well as the need for the Government to reduce the number of regulatory requirements for commercial items. All of the acquisition laws have added 30 to 50% to the costs of doing business with the DoD(Acquisition Law, 1993: 16). The costs have been measured in time and money, and also in the burden of technological innovation (Acquisition Law, 1993: 115).

In a recent General Accounting Office (GAO) report which compares the Army's commercial helicopter purchase with a purchase of a similar purchase in the private sector, it is noted that even with the attempts to procure the item using commercial practices, the Government is still much slower, more manpower intensive, and more costly (GAO, 1995: 2). The report states that vast improvements were made when Government specific requirements were eliminated, and that new laws such as the Federal Acquisition Streamlining Act of 1994 (FASA) opened the way for further improvements. With more implementation of commercial practices, and more elimination of Government specific requirements, the Government could reduce the differences between the Army's buy and a private sector buy, which were the following:

1. the need to comply with a myriad of laws and regulations
2. more extensive and less flexible system requirements
3. the numerous documentation requirements for the proposal and award process, including contingencies such as bid protests (GAO, 1995: 1).

The Streamlining Report states that the acquisition laws should establish a balance between efficient processes and socio-economic policies without requiring contractors to incur additional costs to contract with the Government (Acquisition Law, 1989: 115). It states that commercial practices should be used when commercial products are purchased based on commercial market prices. Any commercial items meeting that definition should be exempt from statutory contract requirements listed in the laws and that the Department of Defense buying practices should be changed to conform to the norms of the commercial market place (Acquisition Law, 1989: 117).

Recently, President Clinton directed the streamlining of government through Presidential Memorandum 09-11-93, called "Streamlining the Federal Workforce" where he directs the reductions in federal workforces. These reductions are accomplished through reductions in "red tape" and empowerment of employees to make decisions. This memorandum had wide impacts including the enactment of FASA which had large impacts on Federal Procurement (Streamlining the Federal Workforce, WWWWeb).

Regulatory requirements are related to alternate means of procurement, buyable purchase requests, efficient processes, accelerated or reduced coordinations, management information systems, and funding issues. All of these factors can be altered in as much that they meet regulatory requirements.

Regulations may increase TALT because of the increased burden put on contracting personnel when purchasing items. Some regulations may, instead also reduce TALT, such as the FASA, which serves to reduce the number of

existing regulations and encourages alternate means of procurement. Since the regulations are as a result of laws enacted by Congress, the effect of regulations is treated as a factor which the process flow must contend with through the use of technology. However, the elimination of regulations is seen as outside the scope of this thesis.

Alternate Means of Procurement. One of the most important factors impacting TALT is the means in which the item is procured. In addition to the normal channels of procurement, there are also a variety of alternate means of procurement. These alternate means include the International Merchants Purchase Authorization Card (IMPAC) card, decentralized Blanket Purchase Agreements (BPA's), Imprest funds, and Electronic Commerce/Electronic Data Interchange (EC/EDI). All of these methods except EC/EDI are methods used outside of, but with the supervision of, the contracting office.

The IMPAC card allows users to purchase limited items under the small purchase threshold and usually under \$2,500.00, redefined to be a micropurchase under FASA (130 Airlift Group Instruction 64-300:1.1.29). The IMPAC card is actually a Visa card, and therefore accepted world wide. The card allows the end users to directly procure items and have them directly shipped to their location. The IMPAC card also has positive utilization for contingency contracting where it allows deployed contracting officers to purchase items without as much need for ready cash.

A BPA is an agreement on terms and conditions that a contractor will provide the requested supplies/services and materials as set forth in the BPA's provisions. (BPA Training Guide, undated:1). Decentralized BPA's allow end users to directly procure from vendors for specific items in the agreement. Decentralized BPA's are closely monitored by contracting officers to ensure compliance and are updated with new price lists as they change.

Imprest Funds are sometimes used for very small dollar items where cash can be used and an item picked up directly. An imprest fund is a cash fund of a fixed amount, established by an advance of funds, without charge to an appropriation. This advance is from an agency finance or dispersing official to a duly appointed cashier, for dispersment as needed from time to time in making payment in cash for relatively small purchases (FAR 13.401). Due to the use of cash, imprest funds are closely monitored and only used for a limited number of items.

EC/EDI is a new technique used for centralized purchases, or those items procured inside the contracting office, where items are procured electronically. EC/EDI is a result of a 26 October, 1993 Presidential Memorandum called "Streamlining Procurement Through Electronic Commerce" where EC/EDI is embraced as a means of reducing "red tape" in Federal Procurement ("Streamlining Procurement Through Electronic Commerce", WWWeb). EC/EDI is explained in greater detail under the "MIS" heading later in the chapter.

Alternate means of procurement factor is related to management information systems, accelerated or reduced coordinations, and efficient

processes factors. The connection to management information systems is due to the MIS needs for reporting decentralized actions and the need to incorporate EC/EDI. Alternate means are related to accelerated or reduced coordinations due to the reduction in coordinations which occurs in the decentralized purchases. Alternate means' relation to efficient processes is because of reduced process steps in decentralized purchasing.

Alternative means of procurement may decrease TALT. Decentralized actions typically reduce coordinations once they are in place. The effect of EC/EDI is still not fully known because it is not fully implemented. All of the processes outside of the procurement office are the same (See process flow diagrams in Appendix B) and therefore the only effect would be internal to contracting. EC/EDI is expected to decrease TALT from the perspective of the contracting office because a more automated technique is being utilized.

Buyable Purchase Requests. It is imperative if items are to be procured in a low amount of time that the contracting office have a buyable package. There is often a great deal of scrap and rework due to purchase requests that are incomplete or inaccurate when they are sent to the contracting office. At Brooks Air Force Base there were 3,207 purchase requests out of a total of 15,019 which had to be sent back to the end users because they had incomplete information (BCAS report, 1996).

It is expected that the receipt of non-buyable purchase requests will increase TALT. Specifically, all processes are the same for suspended purchase

requests other than the fact that they are sent back to the user for additional information. Non-buyable purchase requests equate to scrap and rework for the contracting office.

Customer Access To Information. One problem which affects contracting buyers is the need for information from the users. Typically, users are unaware of the current status of their procurement and will call the procurement buyers for the current status. In most contracting offices, the buyers must stop what they are doing, look up the purchase request, find the file, and tell the end user what the status is. At Brooks AFB, a study was completed tracking each telephone call for a one month period. It was determined that each call was averaging 3 minutes and there were 1500 calls per month. This equates to 75 lost man-hours per month due to status reporting or almost half of one full time worker. (Wann, 1996: interview). Some systems have attempted to compensate for this by granting automated access to users so they can inquire about their procurement and only call buyers if they have questions or problems unrelated to status reporting (BICEP Brief, 1995:21). After access was granted to users through the BICEP system, the number of telephonic status calls was cut almost in half.

The customer access to information factor is related to the Management Information System factor because the information can only be accessed by users through an automated means.



Access to information may decrease TALT because the customers have access to the necessary information, and therefore will be less likely to call buyers directly. This may increase the productivity of the buyers. Access to information may also increase customer satisfaction because customers will not be reliant on buyers for information, they can retrieve the information themselves.

Funding Issues. Funding issues arise in two separate areas. The first is near the end of the fiscal year when planning purchase requests are processed for procurement but can not be completed until the beginning of the next fiscal year. The second area is the funds certification where Accounting and Finance signs that there are funds available for a procurement. This step can often be lengthy.

Planning PR's provide a unique problem because end users must complete these purchase requests for end items and services which are needed immediately in the new fiscal year, but money is not available because the money has not yet been appropriated for the new fiscal year. The end-users will typically process these purchase requests near the end of the fiscal year when contracting offices are already swamped with other purchase requests from end users attempting to spend the end of their current year money.

The second problem is the funds certification process for manual purchase request actions often take an excessive time to process. In a study at Brooks AFB, it was found that purchase requests take 8 to 9 working days to process from the time that the purchase request is delivered to accounting and

finance until the time that it is received at the contracting office (Accounting and Finance Time Study, 1994:1).

Both of the funding issues are expected to increase TALT because they add additional steps in the process flow and increase the workload on contracting during end of fiscal year processing.

Management Information System (MIS). There is one common MIS in place in the Air Force for base level contracting known as Base Contracting Automated System (BCAS). This system's main function is to track all awards and generate purchase orders and delivery orders on DD 1155's. This system currently operates on two platforms, for the active duty Air Force, it operates on a Wang minicomputer, for the Air Guard, it operates on the NCR 3B2 system.

The BCAS system does interface with other organizations in the form of flat file transfers. Currently, the system will send files to Accounting and Finance, Base Supply, and GOCCESS/COCESS. Each of these organizations does not have direct access to BCAS from their computer systems, however their systems are partially updated from the file transfers.

In each organization, the MIS system was functionally developed for each organization's needs. Each of the organization's current computer systems were developed utilizing late 1970's technology before the ability of open systems were widely available. Since each of these systems are closed systems, there is often a great deal of rework required to get items processed between systems,

including altering item descriptions and manually updating accounting information for Accounting and Finance.

There is now a thrust to convert all of these systems into a large open system (Beckman, 1995: 8). The current plan is for all DoD agencies to convert to a migration system so that there is consistency between departments. Eventually, pending funding, there will be an open system, known as the target system, which all agencies will utilize and will include accounting and finance, the supply system and contracting. (Beckman, 1995:8)

There have been some notable attempts to improve on the BCAS system. These systems include Base Contracting Automated System Image Capability Enhancement Program (BICEP) at Brooks AFB and Patrick AFB, Government Acquisition Through Electronic Commerce (GATEC) at Wright Patterson AFB and Financial Electronic Documents Server (FEDS) at Eglin AFB.

The (BICEP) program was initiated at Patrick AFB utilizing image technology from a project at Wilford Hall Medical Center (BICEP Brief, 1995:14). At Patrick AFB, the system is used to scan all of the paperwork for easier access by office personnel and as a tool for follow-up of delinquent purchase orders.

Brooks AFB took the existing program and altered it to include modules for pre-award activities. The following information is taken from the BICEP Brief (BICEP Brief, 1995). Brooks AFB designed BICEP by analyzing the old process flow and automating tasks where possible.



## **SHORTCOMINGS OF OLD PURCHASE REQUEST FLOW**

- 1. NO PR TRACEABILITY**
- 2. CUSTOMERS CALL BUYER FOR PR  
STATUS**
- 3. NO CENTRALIZED TRACKING OF  
REJECTED PRs**
- 4. PAPER SHUFFLING AND DUPLICATE  
HANDLING ADDS TO LEAD TIME**
- 5. 1102'S/64'S DOING DATA  
ENTRY/TELEPHONIC QUOTES**
- 6. LENGTHY DISTRIBUTION TIME**
- 7. PAPER GENERATION / STORAGE**

April 95 BICEP

Figure 2-5. BICEP Shortcomings of Old PR Flow

Each of these items was targeted in the development of the program and the resulting program addressed them in the following ways:



## **PROCESS IMPROVEMENTS**

- 1. PR LOG**
- 2. RFQ FAX-OUT**
- 3. ACCESS TO STATUS BY RESOURCE MANAGERS**
- 4. ELECTRONIC DISTRIBUTION**
- 5. SUSPENSE LETTER**
- 6. ARCHIVING OF IMAGES**
- 7. REDUCTION IN PAPER PRODUCED**

April 95 BICEP

Figure 2-6. BICEP - Process Improvements

1. The PR log gives anyone in the office instant access to the status of the purchase request as well as access to the image copy of the purchase request package. The log also indicates the current buyer with their telephone number. This results in workers being able to find paperwork without leaving their desks. At Patrick AFB, re-engineering the process for distribution of pre-award documents to buyers and the ability to view documentation on-line was expected to provide a 43% increase in productivity (Business Process Reengineering Analysis: BICEP, 93:14).

2. The RFQ fax-out procedure creates a request for quotation and automatically faxes the RFQ to the vendors requested by the team leader. The buyers do not see contracting actions until the file is ready for contract award. This results in freeing buyers from the requirement to obtain telephonic

quotations. This entire acquisition phase was re-engineered. The implementation of this feature at Brooks AFB resulted in a 13 day lead-time reduction.

3. BICEP grants status access to the resource managers so they can see image copies of their PR packages as well as the purchase or delivery orders. If the resource manager needs a copy of any of the items in the file, they can automatically fax a copy to themselves. This results in a reduction of telephone calls to buyers. For more information, see the "Customer Access to Information" subpart in this chapter.

4. BICEP automatically faxes a copy of all purchase orders to the vendors and the end user making manual distribution of the orders unnecessary. This results in a reduction of manpower and paper. The DD 1155's were previously printed on 5 part paper as opposed to the currently used 1 part paper. This change resulted in a \$6,200 annual cost reduction for paper at Brooks AFB. The electronic distribution has also eliminated the equivalent of 2 positions due to the automatic distribution (Business Process Reengineering Analysis: BICEP, 1993:34).

5. BICEP automatically creates a suspense letter to the end user when there is a problem with their purchase request and faxes it to the resource manager. The letter attaches a copy of the PR package as well as any supporting documentation that the resource manager would need. BICEP also keeps a log of all of the suspenses that can be queried, so organizations can be targeted for future training. The results of this feature are two-fold. First, the

buyers are not required to manually suspense items, make photo-copies, and make distribution of PR's with problems. The buyer only makes 1 entry, and all other functions are automated. The second result is a better base-line for training. With the ability to query on items and organizations being suspended, the operational contracting unit is better able to base-line the problems and target the training. However, the quantifiable savings for this feature are difficult to estimate.

6. BICEP archives all transactions in an image format that can be viewed at any time. This archiving does away with the staging process. The resulting savings of this feature were estimated to be approximately \$1,400.00 per year at Patrick AFB (Business Process Reengineering Analysis: BICEP, 1993:26)

7. BICEP reduces the amount of paper created because it creates DD1155's and request for quotations without actually printing copies, or on one-part paper instead of the normal 5-part paper. This has reduced the amount of money spent on paper. The result of this feature is simply the reduction in paper produced. See number 4 above.

At Patrick AFB, it was estimated in the Business Process Re-engineering Analysis prior to full implementation that their version of BICEP would create a return on investment of 104% with a 42 percent increase in productivity (Wang-BICEP, 1993:15). The implementation of BICEP-II at Brooks AFB created the lowest Contract Administrative Lead Time (CALT), or the time from purchase request receipt by contracting to time of award, for Air Force Material Command in 1994-1995 (BOS Horizons, 1995:1). CALT does not account for the time

before receipt by contracting and after award in the BCAS system. TALT accounts for all time from PR inception through delivery.

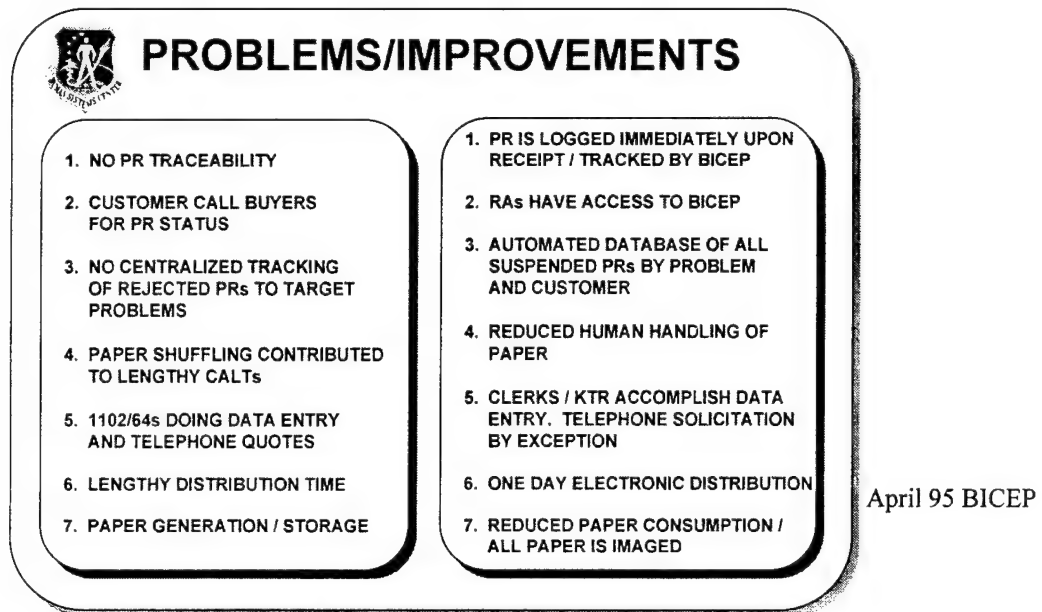
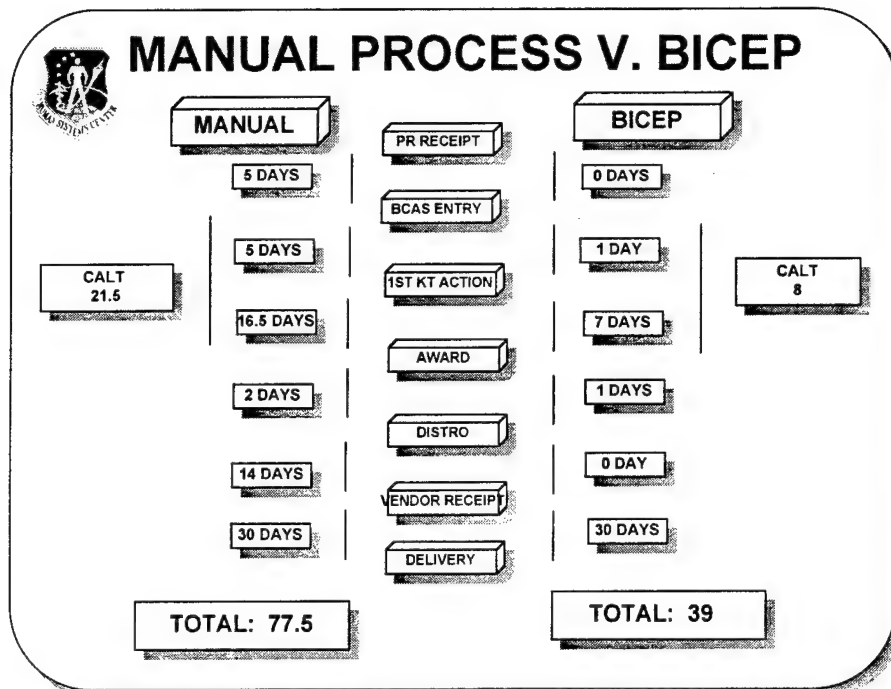


Figure 2-7. BICEP - Problems/Improvements

BICEP took a process approach to small purchase contracting, targeted problem areas and attempted to solve them in a systematic manner. BICEP has affected CALT in the following way:





April 95 BICEP

Figure 2-8. BICEP - Manual Process v. BICEP

The CALT reductions due to BICEP are not only due to the management information system itself. Many additional process improvements were made as a result of the MIS. For example, as the previous slide indicates, prior to BICEP, PR's were in the office for approximately 5 days prior to BCAS entry. This time was used to quality check the purchase request and to assign a buyer for the item. After the implementation of BICEP, the purchase request is immediately input in to BCAS and the quality check is completed later in the process. After BICEP, there is no need to assign a buyer because a team approach is utilized so teams are responsible instead of individuals. (PKO OI 93-4: 1)

It should be noted that pre-award capable BICEP is only operational at Brooks AFB and is not expected to be exported to any other bases in the Air

Force. However, the concepts utilized in the development, and the results gained from the operation, could be used in the development of future systems.

Government Acquisition Through Electronic Commerce (GATEC) was created at Wright Patterson AFB and was the Air Force's first attempt at electronic commerce. GATEC was also the first attempt at the utilization of an "open system" for operational contracting. GATEC utilizes a UNIX based system which updates the BCAS system on the Wang platform.

GATEC sends requests for quotation to vendors using standard transaction sets which allow vendors to bid on items being procured. Wright Patterson is reporting that the increased competition has decreased their costs for the items, and has decreased their workload. GATEC is expected to remain operational at Wright Patterson AFB for the near term.

The Financial Electronic Documents Server (FEDS) system currently being developed at Eglin AFB, allows all financial documents to be electronically coordinated and certified via distribution lists. This system has drastically reduced coordination times from days to hours. The next module under development is expected to allow interface with the BCAS system so all information is automatically updated. Full implementation of this system is still pending full development.

Menu Aided Data Entry System (MADES II) is the current system utilized by the Air Force for EC/EDI. This system was initially developed at Hill AFB (Wojszynski, 1995:4) and is now maintained at Maxwell AFB. Initially, MADES II was a contract writing package for large dollar procurements but was altered to

incorporate EC/EDI. MADES II went fully on-line in the last part of 1994 (Wojczynski, 1995: 4). As of January of 1996, only a small portion of all small purchase requirements are being processed via EC/EDI. The Air Force Base with the most transaction sets is Brooks AFB where the total percentage of small purchases is 8% (Oakes, 1996, telephone interview). Brooks is reporting the main reason for the low utilization of EC/EDI is the inability to use GSA schedules, the inability to split line items on manual purchase requests, the inability of vendor's to bid on items, and the extensive use of "or equal items" with no supporting documentation (Oakes, 1996, telephone interview). It is expected as vendors become more aware of EC/EDI, and procedural problems are fixed, it will be utilized more.

In order to understand how each management information system has been designed to impact TALT, the following matrix is provided:

### Matrix of Solutions by MIS

	GATEC	BICEP	Edwards	FEDS	BCAS	MADES II
Alt Means of Procurement	X	X				X
Buyable Purchase Rqsts		X				
Customer Access to Info		X		X		
Funding Issues				X		
Accelerated Coords				X		
Purchase off-the-shelf						
Use of Socio-economic						
Regulatory	X					X

Figure 2-9. Matrix of Solutions by MIS

The diagram demonstrates how each MIS system has been designed to impact different factors which relate to TALT. GATEC and MADES II both have

utilized EC/EDI which is a form of alternate means of procurement. BICEP has utilized fax technology as its alternate means of procurement.

BICEP is the only MIS which has attempted to track suspenses to determine the reason for problems. While BICEP does nothing to directly correct deficiencies in purchase requests, it does allow managers to target training for organizations with consistent problems.

BICEP and FEDS both allow customer interface with the systems to allow for information gathering by the users. This interaction allows customers to determine status without calling buyers or coordination points.

FEDS is the only system which deals with funding issues. The system is designed to allow coordinations of manual purchase requests quickly, and allow PR tracability throughout the process flow. FEDS is also the only system which allows for accelerated coordinations through the use of e-mail instead of Base Information Transportation System (BITS) or hand-carrying PR's.

None of the systems attempt to force users to purchase off-the-shelf items. All of the systems are designed to allow users to purchase any type of product. However, in an operational environment, it is very rare for developmental items to be purchased.

Use of socio-economic programs are not specifically addressed by any of the information management systems. The socio-economic requirements are set by regulation or law and only affect the vendors which are selected for the Request for Quotations (RFQ).

MADES II and GATEC both attempt to fulfill regulatory requirements by utilizing EC/EDI. The use of EDI has been mandated both by FASA and Executive Order ("Streamlining Procurement Through Electronic Commerce" WWWeb).

It is expected that different automation techniques have varying effects on TALT. There is data to support this theory through comparisons in CALT between bases with local initiatives and bases without local initiatives. A thorough comparison of these CALT's is made in chapter 4.

The idea of improving process flows through the use of different MIS's is not new. There have been some notable attempts in the Base Supply arena and in the Medical Logistics arena. In the 2750th Supply Squadron at Wright Patterson AFB, Wang Laboratories accomplished significant work in attempting to simultaneously improve process flows and increase productivity through improvements in the MIS. Wang noted that simply automating existing processes have failed to generate significant productivity gains, but that via a thorough process redesign, automation can successfully improve productivity (Max Value Analysis, 1991: Preface). Their Demand Processing Enhancement Program (DPEP) is Wang's attempt to integrate all of the functions within Base Supply and simplify their processes. Wang expects the DPEP system will create a 60% increase in productivity with a 933% return on investment and a payback period of less than a year (Max Value Analysis, 1991: 2).

Another notable attempt at improving processes through the use of automation is Wang's MedImage Program at Wilford Hall Medical Center in San

Antonio, Texas. This same type of consolidation of processes and automation of tasks is expected by Wang to produce a return on investment of 225% with a pay back period of 3 years and a 51% productivity increase (Medimage, undated:1)

These other automation systems, while not utilized in the contracting arena, demonstrate simultaneous process improvement and automation can result in significant overall savings and significant productivity gains.

Purchase of Off-The-Shelf-Items. The FASA directed new procedures which have seriously changed the way in which DoD procures items. First, it deleted almost all military specifications and standards and moved toward purchasing commercially available items. This strategy allows the government to take advantage of the lower costs and the higher quantities that are found in this far larger market (P.L. 103-355, section 8002).

The major factor changing contracting for the Department of Defense is that the Government is no longer at the leading edge of technology in many instances, and the Government is sometimes responsible for stifling technological growth. In a recent press conference concerning acquisition reform, Defense Secretary Perry and Deputy Under Secretary of Defense for Acquisition Reform Preston, stated that need for the reduction in military specifications and standards is due to the growth of technology to the extent that commercially available items are rugged enough and technologically able to be used in the Government (SECDEF, 1994:9). The Government can save the

front-end costs associated with fielding new equipment by using commercially available products which have already been proven in the commercial sector. Additionally, since the Government currently only purchases for governmental applications, the production runs are much smaller and therefore the cost savings of having large production runs can be seen by utilizing products which are also commercially available (SECDEF, 1994:9).

It is expected that the purchase of commercial products will reduce TALT because development time will be eliminated. It is known that the DoD will have a need to procure special items for military use, however, these items will generally be of a value over the small purchase threshold and, therefore, not under consideration of this study.

Accelerated or Reduced Coordination Points. One of the major problems resource managers encounter is the many coordination points which purchase requests must go through before they are ready for contract action. Typically, a manual purchase request must receive coordination from four to ten different coordination points before it can be purchased by contracting. All manual purchase requests must be coordinated by the supervisor of the user, the resource manager, and Accounting and Finance (AF Form 9 Preparation Guide, undated:2). Other common coordination points include Base Supply, Medical Supply, Civil Engineering, Hazardous Material Pharmacy, Safety, and Audio Visual Center (AF Form 9 Preparation Guide, undated:2). Each of these coordination points adds to the total acquisition lead time for the procurement,

and with the exception of FEDS, there currently is not an automated technique for these coordinations.

Process Flows. Now that we've looked at the factors affecting TALT, we turn our discussion to TALT itself. The process for acquiring items is different depending on the method of procurement and are especially different for automated customers like Base Supply, Medical Supply, and GOCESS/COCESS.

Each of the process flows have common elements which lend themselves to a common process flow which can be used for study. The process flow from PR inception through final payment for Base Supply, Medical Supply, GOCESS/COCESS, manual purchase requests, BICEP, EC/EDI, and a Theorized Common Process Flow can be found in Appendix B. Each of the different using organizations have a different means of getting the purchase request to the contracting office. Each of the different MIS systems have a different means of getting bids for items. When examined globally, the actual actions are very similar in their intent and can be generalized in the following fashion:



## Theorized Common Process Flow

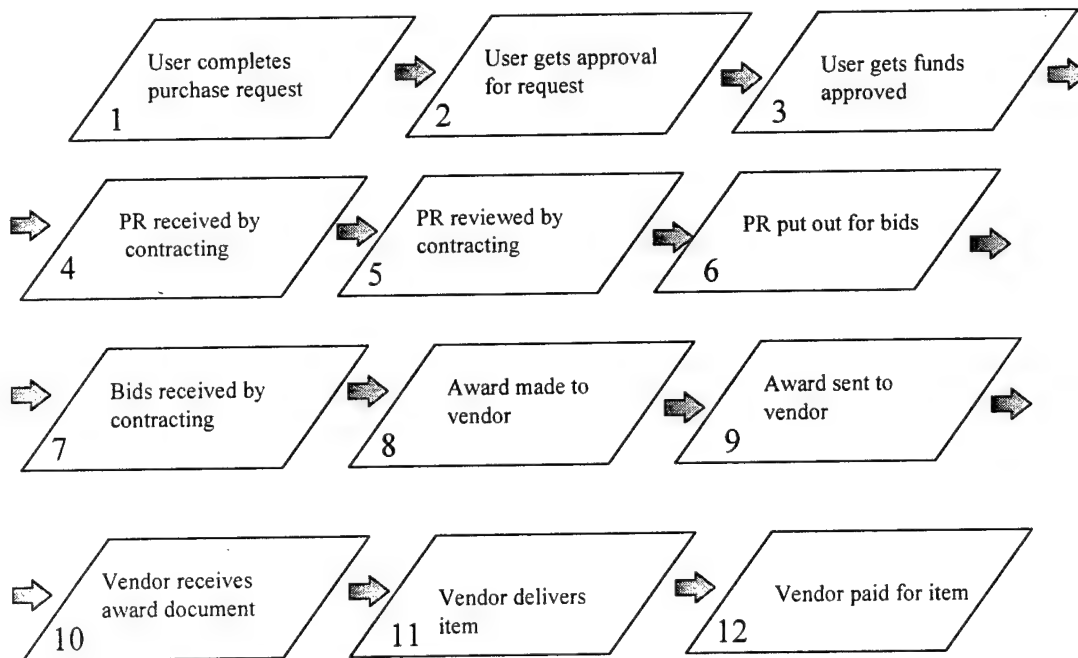


Figure 2-10. Theorized Common Process Flow

In general, each user must get a funded requirement approved and to the contracting office for subsequent approval. After the requirement is received and approved by contracting, the purchase request is put out for bids. Following receipt of bids from vendors, an award is made to the appropriate vendor. After the vendor receives the award and delivers the item, payment is made.

The specifics of how each using organization differs, and how each MIS system handles the requests for quotations is delineated below.

Step 1- User Completes Purchase Request. At most bases, this step is handled manually on a typewriter, or using an automated forms generation program such as Delrina's Perform Pro, or Wang's Formsgen. In the FEDS system, this step is

handled in a completely automated fashion. If the item is handled through the Medical or Base Supply Systems, the requirement is generated on a DD 1348-6 or AFMC 3045. If the item is handled through GOCESS or COCESS, a work order is approved through the Civil Engineering channels.

Step 2 - User Gets Approval For Request. The approval process is handled in a completely manual process, except for the FEDS system. Typically, the form is hand-carried to each coordination point for approval. Under the FEDS system, the form is electronically mailed through the base local area network (LAN) where it is approved electronically. In Base or Medical Supply, the approvals take place in the same manual fashion, with the approvals on the AFMC 3045 or AF 1348-6. In GOCESS or COCESS, the approvals take place on the work order.

Step 3 - User Gets Funds Approved. Typically, this step is handled by giving the manual purchase request to the Accounting and Finance office where it is certified. In the Base and Medical Supply systems, money has already been certified for each organization, and put into the stock fund. For GOCESS or COCESS, money has already been certified in a AF 616

Step 4 - PR Received by Contracting. In all systems, contracting will receive the document, either manually or electronically. For the manual purchase request, generally, the form is manually routed to the contracting office after certification.

Under the FEDS system, this step will be handled through the MIS. For GOCESS, Base Supply, or Medical Supply, the requirement is electronically transferred using a flat file transfer.

Step 5 - PR Reviewed by Contracting. Inside the contracting office, the requirement is reviewed prior to it being issued to the public for bids. This review is conducted by a buyer or manager in the contracting office, and is not affected by the MIS system.

Step 6 - PR Put Out for Bids. When the requirement is ready to be sent out for bids, each system handles the transfer differently. In most BCAS offices, this is handled by telephonic quotations. In a BICEP office, a written RFQ is automatically generated and faxed to the vendors. In a GATEC or MADES II office, the requirement is sent to vendors through electronic data interchange to value added networks which allow vendors to place bids on items over their computer.

Step 7 - Bids Received by Contracting. In BCAS offices, this step is handled at the same time as step 6, on the telephone. In the BICEP office, the vendors fax the requirement back to the office where it is held until the expiration of the RFQ, typically 3 days. In a GATEC or MADES II office, the vendor sends its quotes back to the office through Electronic Data Interchange.

Step 8 - Award Made to Vendor, Step 9- Award Sent to Vendor. In BCAS offices, the DD 1155's are manually separated, a copy is sent to the vendor through the mail, a copy is sent to the user through BITS, two copies are sent to Accounting and Finance, and a copy is held in contracting. In the BICEP office, the DD 1155 is automatically faxed to the vendor, a copy automatically faxed to the user, and a copy is sent to Accounting and Finance. The contracting office only keeps an image of the DD 1155. In a GATEC or MADES II office, the award is sent via EDI to the vendor, a copy of the 1155 is sent through BITS to the user, 2 copies are sent to Accounting and Finance, and a copy is retained by contracting.

Step 10 - Vendor Receives Award Document. In the BCAS office, the vendor receives the 1155 through the mail. In the BICEP office, the vendor receives the 1155 on the fax machine. In the GATEC and MADES II offices, the vendor receives the EDI award on their computer.

Step 11 - Vendor Delivers Item. In all systems, the vendor will ship or construct the item, or perform the service.

Step 12 - Vendor Paid for Item. In all systems, the vendor is paid either by mailed check or by Electronic Funds Transfer (EFT).

The Theorized Common Process Flow provides the construct to measure TALT. Each of the times in the process flow can be measured. If any of the

incremental times can be reduced, the entire time can be reduced because of the "pipeline" nature of the process flows.

Each of the factors have effects on different processes which lead to TALT. The interaction between process and factor is described in Figure 2-11.

## Matrix of Processes

	Process Flow Step											
	1	2	3	4	5	6	7	8	9	10	11	12
Management Info Sys	X	X	X	X		X	X	X	X	X		
Alt Means of Procurement						X	X	X	X	X		
Buyable Purchase Rqsts					X							
Customer Access to Info				X	X	X	X	X	X	X	X	X
Funding Issues			X									X
Accelerated Coords		X	X									
Purchase off-the-shelf	X				X							
Use of Socio-economic					X	X						
Regulatory												

Step 1: User Completes Purchase Request  
 Step 2: User Gets Approval For Request  
 Step 3: User Gets Funds Approved  
 Step 4: PR Received by Contracting  
 Step 5: PR Reviewed by Contracting  
 Step 6: PR Put out for Bids  
 Step 7: Bids Received By Contracting  
 Step 8: Award Made To Vendor  
 Step 9: Award Sent To Vendor  
 Step 10: Vendor Receives Award Document  
 Step 11: Vendor Delivers Item  
 Step 12: Vendor Paid For Item

Figure 2-11. Matrix of Processes

Factor 1: Management Info System. The MIS interacts with all of the steps in the process flow except 5, 11 and 12. 5 is not affected because the review is handled manually by either a senior buyer or a member of management. Steps 11 and 12 are not affected because they deal with delivery and payment, and therefore not affected by the MIS in the Government.

Factor 2: Alternate Means of Procurement. Steps 6 through 10 are affected by Alternate Means of Procurement when EC/EDI is utilized. No other types of alternate means of procurement can be measured in the theorized common process flow because they are decentralized.

Factor 3: Buyable Purchase Requests. Step 5 is affected by buyable purchase requests where the purchase requests are reviewed by the contracting office. It is at this step that contracting personnel would send items back to users for additional information.

Factor 4: Customer Access To Information. Customer Access to Information is only possible after contracting has the purchase request under the BICEP system. This occurs in steps 4 through 12.

Factor 5: Funding Issues. Funding issues only play a role in step 3 of the process flow, when the money is certified. Occasionally, funding issues will arise when additional funding is needed, which can occur at any step after step 3, or when a modification occurs, which would occur following step 12.

Factor 6: Accelerated Coordinations. Accelerated coordinations can only occur in steps 2 and 3, when various check points sign the document, and certification of funds by Accounting and Finance occurs.

Factor 7: Purchase off-the-shelf-items. Factor 7 only has an impact at step 1 and step 5, when the user initially decides what to purchase, and when the contracting office determines the appropriateness of the purchase request.

Factor 8: Use of Socio-Economic Programs. Factor 8 has an impact when the contracting office is reviewing the purchase request, step 5, to determine who should be solicited, and in step 6, when the bids are sent to vendors who qualify for various socio-economic programs.

Factor 9: Regulatory. Regulatory considerations must be made at each step in the process flows, but do not directly impact any step in particular. For the purposes of this thesis, regulations are considerations which must be dealt with at each stage of the process, but the impacts can not be directly measured from the theorized process flow.

It is important to note that all of the factors, and their impact on the various process flow steps dictate the efficiency of the overall process of procurement of small purchase items. Incremental improvements in the factors can result in an overall increase in efficiency, if they do not adversely affect other factors.



### Propositions

Each of the factors in the efficient procurement model which affect TALT lead to theoretical propositions. Negative correlations with TALT mean that TALT would increase. Positive correlations with TALT mean that TALT would decrease.

#### P1: Use of Socio-economic programs is negatively correlated with TALT.

It is expected that the use of socio-economic programs cause delays due to the reduction in the base of vendors which are eligible for contract award. It is further expected that small vendors often act as "10 percenters" who purchase items from larger companies and then sell to the Government, adding their 10 percent. This type of activity adds to delivery time, which would also add to TALT.

The proposition can be measured by reviewing the difference in time between steps 4 and 8 (CALT) in the theorized process flow. A correlation between CALT and the socio-economic program utilized will demonstrate the effect of socio-economic programs on TALT.

#### P2: Regulatory requirements are both positively and negatively correlated with TALT.

It is expected that regulatory requirements which cause longer processing times add to TALT and regulatory requirements which reduce other existing

requirements reduce TALT. An example of a reduction in regulatory requirements would be a change allowing alternate means of procurement.

P3: Alternate means of procurement are positively correlated with TALT.

It is expected that the use of alternate means of procurement, including IMPAC, EC/EDI, BPA's, Imprest Funds, and SF44's reduce TALT due to reductions in processing times and coordinations.

This effect can be determined by correlating the time between steps 6 and 7 in the Theorized Common Process Flow with the method of procurement, either EDI or non-EDI. All other methods of alternative procurement techniques are decentralized, and therefore can not be measured in this thesis. An assumption is made that the other methods of alternate means of procurement are faster, because the number of steps required for decentralized purchasing, once set up, are much fewer.

P4: Buyable purchase requests are positively correlated with TALT.

It is expected that a reduction in the number of purchase requests with errors and omissions would reduce TALT. Each time that a purchase request is sent back to the user for additional information, a corresponding increase in TALT is incurred.

This effect can be measured by determining the amount of time required for suspended requirements between steps 5 and 6 using the BICEP system.

P5: Customer access to information is positively correlated with TALT.

It is expected that as customers are given access to automated status information, they do not take contracting time away from buyers. This access must be given in an automated fashion to incur a reduction in man-hours lost to status reporting.

This effect will be mixed with the results of the use of BICEP at Brooks. Since access to information is only available through BICEP, the effect of access to information will not be able to be distinguished from the effect of BICEP as an MIS. For this reason, this effect will not be directly measured.

P6: Funding issues are negatively correlated with TALT.

It is expected that the Accounting and Finance coordination adds another step in the process flow which adds time to TALT. It is also expected that the "end of fiscal year rush" adds workload to the contracting office which adds to the overall TALT during that time of year.

This effect can be determined by determining the time between steps 3 and 4 in the Theorized Common Process Flow. The effect of "end of fiscal year rush" will not be distinguishable, therefore only the effects of certification of funds will be studied.

P7: Management information system is both positively and negatively correlated to TALT.

It is expected that an MIS which reduces processing time and automates mundane tasks will reduce TALT, while an MIS which adds steps in the process for status and management reports will increase TALT.

The effect of each type of MIS can be determined by study of the times for steps 4 through 8 to determine the effect of BCAS, GATEC, MADES II, and BICEP.

P8: Accelerated or reduced coordinations are positively correlated with TALT.

It is expected that as coordinations are eliminated or accelerated, a corresponding decrease in TALT will occur. Each coordination in the process flow adds to TALT since the process flow only occurs in a linear fashion.

This effect can be determined by determining the time between steps 1 and 4. As this time is reduced, the correlation is stronger.

P9: The purchase of off-the-shelf items is positively correlated with TALT.

It is expected that when items are purchased from off-the-shelf, development time is eliminated and a corresponding time is eliminated from the delivery time. This factor has very little impact for small purchase items since most development occurs over the small purchase threshold. Since this factor has such a small impact on small purchase in an operational environment, it will not be studied in this thesis.

## Conclusion

Chapter 2 is a comprehensive review of the literature concerning total acquisition lead time in a small purchase environment. In this chapter a model of efficient procurement was created showing the factors which lead to efficient procurement. One of these factors was TALT, which is the focus of this study. The factors which impact TALT were identified and their correlation was hypothesized. Chapter 3 is the methodology for the research. In this chapter, the variables will be operationalized, and the method of research described.

### 3: Methodology

#### Introduction

In Chapter 2, a model for efficient procurement was developed, containing 5 factors; Customer Satisfaction, Reasonable Cost/Price, Abuses, Strong Industrial Base, and Total Acquisition Lead Time (TALT). It was determined the only one of these factors which managers, at an operational contracting level, could influence for small purchase orders was TALT. All of the other factors have large implications for regulation and law which can not be changed at a local level.

Also in Chapter 2, 9 factors were identified which affect TALT; buyable purchase requests, alternate means of procurement, regulatory requirements, use of socio-economic program, purchase of off-the-shelf items, accelerated coordinations, management information systems, funding issues, and customer access to information. This chapter shows the methodology of how the 9 factors affect TALT and efficiency of the contracting processes.

#### Overview

In Chapter 2, the nine factors were created in the model, and described to affect Total Acquisition Lead Time (TALT). Now that the model has been created, data collection can occur, and statistical tests used to determine if these factors do affect TALT. The data collection takes place at 5 different sites in the

CONUS US Air Force. The bases are of different sizes, locations, commands, and functions to allow for broad generalizations.

After the data collection takes place, statistical analysis is necessary to determine the effects of the factors on TALT. The first statistical test is the qualitative regression analysis. This test indicates the statistical significance of each factor on TALT. After the regression analysis demonstrates the significance, descriptive statistics are used to determine the usage of each of the factors and to parse, or separate the time within TALT to assign responsibility. The final part of the statistical test is the Bonferonni Technique which will be used to determine if there is a difference in the mean processing times for the different management information systems. The Bonferonni Technique will also be used to determine if there is a difference in the mean delivery times for different socio-economic programs.

At the conclusion of this analysis, generalizations can be made about the factors. These generalizations can be used to for future research and in development of regulation, process flows and management information systems.

### Research Questions

The statistical tests described previously is utilized to test the basic research questions. The first question is:

Q1. How does the use of socio-economic programs correlated with TALT.

This question is studied in three different ways. First, the regression analysis is used to determine, qualitatively, if there is a correlation between the business type, either large, small, or other socio-economic program, with TALT. The p-value in the regression output will determine if the factor is significant, and the sign identifies if the factor has a positive or negative correlation with TALT. The regression analysis only shows the correlation between the socio-economic program and the time from purchase request inception to time of award in the BCAS system, also known as TALT-del.

The second step in the analysis of this question uses descriptive statistics to show the usage of each type of socio-economic program for each MIS. This analysis helps to show, quantitatively, the magnitude of the usage of each type of program, but does not show the impact of the programs on TALT.

The third step in the analysis is to show the impact of socio-economic program on delivery of items. This is accomplished by using an Analysis of Variance with the Bonferroni Technique. This technique shows groupings of the small, large, and other socio-economic program, to show if there is a difference in the means of any of these programs. Since the information about the delivery of the items is not available for manual purchase request actions, a proxy for vendor delivery is utilized.

The answer to this question will be apparent as the regression analysis will show the statistical significance and direction of impact that socio-economic



programs have on TALT. The descriptive statistics will then show the usage of each type of socio-economic program. The Bonferroni Technique will show the impact of socio-economic program on performance of the purchase order.

## Q2 How do regulatory requirements affect TALT?

Since regulatory requirements are so pervasive in government contracting, it is difficult to parse the regulatory factor from other factors. For the purposes of this research, only one aspect of regulation is considered, competition. To determine the effect of competition, a two step approach is utilized. The regression analysis is used to determine the significance of competition on TALT, and the sign of the coefficient will show the direction of the impact of competition on TALT. After the significance is determined, descriptive statistics are utilized to determine the usage of competition for each MIS. The descriptive statistics show the magnitude of usage of competition for each MIS, but do not show the correlation of competition on TALT.

The information about competition is found in the BCAS file called AwardPR which holds all information about awarded purchase orders. A field in this file indicates if the order is competitive, not competitive or exempt from competition. For the purposes of this research, exempt is equivalent to competitive because competition is not required.

The answer to this question will be apparent as the regression analysis will show if competition is significantly correlated with TALT, and if it is, the direction of correlation, or if competition increases or decreases TALT.

Descriptive statistics will then show the percentage of competition for each MIS and Base in the study.

Q3. How do alternate means of procurement impact TALT?

There are three main alternate means of procurement, the IMPAC card, decentralized BPA's, and Electronic Commerce (EC). Since the IMPAC card and decentralized BPA's are not handled directly through the contracting office, the impact of the decentralized purchases is not able to be determined. The impact of EC, however, is able to be determined. This one aspect of alternate means of procurement is studied in two steps. The first step is the regression analysis which will show qualitatively, if there is a significant impact on TALT. The p-value indicates if the factor is significant. The sign of the coefficient indicates the direction of the impact. The second step is through the use of descriptive statistics which shows the usage of EC by each MIS.

This information is collected through an inquiry into the AwardPR file in the BCAS system to determine if EC/EDI is utilized. At all sites, if MADES II is utilized, the project title field indicates "MADES II AWARD". For Wright Patterson, it is determined if GATEC is utilized because a separate indicator is used in the Branch field.

The answer to this question will be apparent as the regression analysis will show if electronic data interchange (EDI) is significantly correlated with TALT, and if it is, if EDI increases or decreases TALT. Descriptive statistics will then show the usage of EDI for each MIS and Base in the study.

Q4. What is the impact of the contracting office receiving purchase requests which are not adequate for purchase?

This question is analyzed in two parts. First it is analyzed qualitatively through the regression analysis. The p-value shows significance of the factor and the sign shows direction of impact on TALT. The second step is through the descriptive statistics to show the impact of MIS on suspensions of PR's by indicating the percentage of purchase requests which are suspended in the BCAS system.

This information is located in the AwardPR file in BCAS which indicates the number of days that a purchase request is suspended in the BCAS system. This time is not normally counted against a contracting office when computing statistics about performance.

The answer to this question will be apparent as the regression analysis will show if suspended purchase requests are significantly correlated with TALT, and if they are, if suspended purchase requests increase or decrease TALT. Descriptive statistics will then show the percentages of suspended purchase requests by MIS and Base in the study.

Q5. What is the impact of automated access to information on TALT?

This answer can not be directly measured because only one MIS allows automated customer access, BICEP. This means that any effect that is the result of allowing customers to access information can not be distinguished from

BICEP as an MIS, or that there is no variance to study. For this reason, this question is not directly addressed, but rather is incorporated in Question 7.

Q6. How do Funding Issues affect TALT?

There are a variety of funding issues described in Chapter 2. The only funding issue which is quantitatively determined is the impact of certification of funds on purchase requests by the Accounting and Finance Office. The other funding issues, including "end of year rush" can not be directly measured because the data is not present in the MIS's on the impact. The impact on the certification of funds is measured by parsing the times throughout the funding cycle. The impact is measured by subtracting the time from receipt of the purchase request by accounting and finance to the time of receipt by contracting.

The answer to this question will be apparent as descriptive statistics will be used to show the processing times in Accounting and Finance. These mean times will indicate the impact of certification on TALT.

Q7. How do different Management Information Systems (MIS) affect TALT?

This question is analyzed in four steps. The first step is through a qualitative regression analysis. The significance of each type of MIS is determined by the p-value. The sign of the coefficient determines if the impact on TALT is positive or negative. The second step is through descriptive statistics, which indicates the total TALT for each type of MIS. This step quantitatively determines the TALT, in days, for each type of MIS. The third step

is through the parsing of times throughout the procurement process to determine, quantitatively, the impact of the MIS on TALT.

The last step in the analysis will be to determine the TALT including the delivery time, and determine if there is a difference in the mean TALTs for each of the MIS's using an analysis of variance with the Bonferonni Technique. This will allow groupings of MIS's to determine which have the most impact on TALT.

The Management Information System(MIS) Factor is measured by determining the system which is utilized in the procurement. This information is in the BCAS award file for BCAS, GATEC and MADES II systems. For MADES II, the Project Title field reads "MADES II" Award. For the GATEC system, a separate indicator is utilized in the Branch field. The BICEP system is determined by query into the BICEP MIS to determine if BICEP is utilized. It should be noted that all Operational Contracting units in the Air Force use BCAS, therefore all other systems also use BCAS in their processing. For example, at Brooks Air Force Base, it is recorded as a BICEP award if BICEP is utilized, even though BICEP and BCAS are used concurrently. There is no direct impact of this other than putting all bases on a level playing field because all must use the mandated BCAS system. Local initiatives are still measured, but all must still use the BCAS system.

The answer to this question will be apparent as the regression analysis will show if the MIS's are significant, and if they are the direction of the impact on TALT, or if they increase or decrease TALT. Descriptive statistics will then show usages of each type of MIS. The parsing will show the internal components of

each phase in the procurement cycle. The Bonferonni Technique will show, quantitatively, which of the MIS's has the greatest impact on TALT.

Q8. How do accelerated or reduced coordinations affect TALT.

Since the small purchase process is a "pipeline process", or all activities are sequential, it is expected that with any acceleration of a portion of the process, a corresponding reduction in the TALT occurs. To quantitatively determine the impact of coordinations on TALT, parsing of the procurement process is utilized to determine its impact on TALT.

The answer to this question will be apparent as the parsing of internal times in the procurement cycle are studied. Each step in the procurement process will show the responsibility of time for each organization involved in the process.

Table 3-1. Questions and Methods of Test

Question	Methods of Test
1. Socio-Economic Programs	Regression Analysis, Descriptive Statistics, Bonferroni Technique
2. Regulatory Requirements	Regression Analysis, Descriptive Statistics
3. Alternate Means of Procurement	Regression Analysis, Descriptive Statistics
4. Inadequate Purchase Requests	Regression Analysis, Descriptive Statistics
5. Automated Access to Information	Not directly Measured
6. Funding Issues	Descriptive Statistics
7. MIS	Regression Analysis, Descriptive Statistics, Parsing, Bonferroni
8. Accelerated or Reduced Coordinations	Parsing

### The Process Flows

In Chapter 2, a theorized common process flow was developed. This chart provides the basis for the research in this thesis. The TALT measurements for each site selected is measured utilizing the theorized process flow, with slight differences due to availability of data resulting from differences in Management Information System (MIS) systems.

### Limitations of Process Flow

The theorized process flow has a few limitations. This process flow is only applicable to small purchase actions of routine priority. Large dollar purchases require a greater level of coordinations and increased information

generation prior to receipt by contracting, different levels of approval once in contracting, and advertising requirements in the Commerce Business Daily. Much of the processing for large dollar purchases can occur concurrently, instead of the "pipeline" fashion implemented for small dollar purchases. For example, there is a process of PR planning, whereby work is often conducted in contracting before funds are certified (AF Form 9 Preparation Guide, 3).

In most operational contracting offices, the vast majority of line items are for small dollar procurements. While the large dollar procurements require much more time and effort by the contracting professionals, the volume of line items are in the small purchase arena. For these reasons, large dollar procurements are not studied in this thesis.

The theorized process flow is often not applicable to high priority items. If a requirement is urgent, steps in the process flow are frequently skipped or accelerated (PKO OI, 93-4, 4). The Contracting Officer is required to ensure all regulatory requirements are met for all purchase requests, regardless of priority; however, contracting personnel usually work with using organizations to ensure high priority purchases take place expediently, ensuring mission readiness. Only routine priority items, which typically account for 70-90% of the items, are selected for review. There is certainly an impact on routine requirements because of the different process flows for high priority requirements (PKO OI 93-4, 5), however these effects are considered to be negligible for the purposes of this thesis because of the relatively low numbers of high priority items. Since



additional efforts are made to guaranty high priority items are procured, with variations in the process flow, they are not considered in this study.

The theorized common process flow is only applicable to the Supply, or Commodities Branch, in an Operational Contracting Squadron. In a Services Branch the process flows are different due to coordinations with the Base Manpower organization (PKO OI 93-4,2), and differences in the procurement procedures. For services orders, the contract award is only the beginning of contracting's responsibility because the order must be administered for the entire performance period. The Construction Branch usually has only one customer, Civil Engineering (CE). There is typically a tight working relationship between the Construction Branch and the Civil Engineers using a closer business relationship instead of the theorized process flow. Construction orders require the same administration as the Services Branch because orders are administered for the entire period of performance.

The common process flow is applicable to all using organizations, both manual and automated. However, even though the process flow is similar, the data for TALT in the automated process flow is not as easily accessible. Automated customer information is spread across many different systems, including Base Supply, Medical Supply, GOCESS, and Accounting and Finance. All of the information about manual purchase request's is present on the face of the form. For this reason, only manual Form 9 customers will be studied in this thesis, which will give a representative sample of all orders. As can be seen in Appendix B, the process "pipeline" for manual purchase request and automated

customers is so similar, that the effects of the origin of the requirement are considered to be negligible. In order to verify this assumption, a statistical test will be utilized to compare the means between automated and manual customers in chapter 4.

### Site Selection

Five different sites were selected for analysis, Brooks Air Force Base in Texas, Wright Patterson Air Force Base in Ohio, Grissom Air Force Base in Indiana, Scott Air Force Base in Illinois and Springfield Air National Guard Base. The differences between these bases are noted in Table 3-2.

Table 3-2. Bases Used in Data Collection

Air Force Base	Size	Location	Command
Brooks	small	South/Central	AFMC
Scott	large	Central	AMC
Grissom	small	Central	Reserve
Wright Patterson	large	North/Central	AFMC
Springfield	small	Central	ANG

As seen Table 3-2, the bases are heterogeneous, and should allow for broad generalizations across the Air Force because of differences in base size, location, and command. The bases are homogeneous in the sense that they all purchase the same type of operational support items, and have similar process flows. The site selections account for variations in size, location, and command. By combining the data from all of the different types of sites, the variances of each command, size of base, and location of base can be maximized and the

factors in the model which are believed to be present at all Air Force Bases can be analyzed. This combining of data increases the external validity of the results and allows for broad application of results to all domestic bases which are similar to the sample data.

There are two main variations this site selection does not account for, overseas operations and contingency operations. The overseas operations operate in a completely different environment, with wide variations in regulatory requirements. Any generalizations taken from this study should be used with caution when dealing with overseas bases. Contingency operations are also not accounted for because a vastly different process flow is utilized.

#### Data Collection

Data collection is accomplished differently for each site, but with the same result, BCAS reports and copies of manual purchase request's. Data collection at Brooks AFB occurs through the use of a remote logon. A management report is remotely created providing information from the AwardPR file in BCAS. The AwardPR file is the main file which records all information about awarded purchase orders, delivery orders, and contracts. The report limits the data to items in the Supply Branch, with a priority of 9 (routine), under \$25,000, and with award dates from 28 February 1995 to 1 March 1996. These criteria allow the data to be tailored to the limitations of the thesis, including small purchases, in the supply branch, of routine priority. From each report, a random sample of 100

data points will be taken using a random number generator (Cooper, 1995: 666). At Brooks Air Force Base, the 100 data point images are directly printed at that site. All images were sent to Wright Patterson via the U.S. Postal Service.

At Wright Patterson AFB, the 100 random samples are generated using the same technique. Each of the manual purchase request's are found in the office records, and the applicable dates taken from the face of the forms.

At Grissom AFB, Scott Air Force Base, and Springfield ANG station, a site visit is conducted. The BCAS reports using the same criteria as above is created, and a manual review of the records is conducted.

At all sites, a separate management report are created for the delivery of items showing the difference between the expected delivery date and the actual delivery date and the vendor type to determine the effects of socio-economic program on the delivery of the items.

### Statistical Analysis

A variety of statistical tools are utilized to determine the effects of the factors on TALT. These tools are: a regression analysis, descriptive statistics, and a Bonferroni Technique for comparison of means, both to be described in detail below. Two different software packages are utilized for the statistical analysis: SPSS version 6.1 student version and Statistix version 4.1. The first statistical analysis to be conducted is a regression analysis using qualitative variables.

Regression Analysis. A regression analysis is utilized to determine the effects of the qualitative factors on TALT. Since the regression model used is a qualitative model, a positive or negative correlation will be established, and the significance of each factor is determined, but the magnitude of the correlation is not known from this test. The model will have 11 different factors, each with different levels. The model will appear

$$\text{as: } E(y) = \beta_0 + \beta_1 \text{MIS1} + \beta_3 \text{MIS3} + \beta_4 \text{MIS4} + \beta_6 \text{MIS6} + \beta_7 \text{ALT} \\ + \beta_8 \text{SUS} + \beta_9 \text{SOC1} + \beta_{10} \text{SOC2} + \beta_{11} \text{SOC3} + \beta_{12} \text{COMP}$$

where:

$E(y)$  = TALT

$\beta_0$  = Constant

$\beta_1$  = Coefficient on BICEP

MIS1 = Level 1 for BICEP

$\beta_3$  = Coefficient on GATEC

MIS3 = Level 3 for GATEC

$\beta_4$  = Coefficient on MADES II

MIS4 = Level for MADES II

$\beta_6$  = Coefficient for BCAS

MIS6 = Level for BCAS

$\beta_7$  = Coefficient for Alternate Means of Procurement

ALT = Level for Alternate Means of Procurement (1=EDI, 0=non-EDI)

$\beta_8$  = Coefficient for Buyable Purchase Request

SUS = Level for Buyable Purchase Request (1=Suspended, 0=not Suspended)

$\beta_9$  = Coefficient for Socio-Economic Program (L)

SOC1 = Level for Socio-Economic Program (L)

$\beta_{10}$  = Coefficient for Socio-Economic Program (S)

SOC2 = Level for Socio-Economic Program (S)

$\beta_{11}$  = Coefficient for Socio-Economic Program (O)

SOC3 = Level for Socio-Economic Program (O)

$\beta_{12}$  = Coefficient for Regulatory

COMP = Level for Regulatory (1=Competitive 0=Not Competitive)

The level at which a factor will be considered significant in this study is alpha equal to .05. This significance level allows for a 95% confidence that the factors are significant. Once the significance of the effect is determined, a more in-depth analysis occurs using the descriptive statistics for further parsing of data. The 95% confidence interval is the generally acceptable level for this type of analysis (McClave and Benson: 1994, 309)

The TALT model is created to provide a good fit to a set of data that will give good estimates of the mean value of TALT and good predictions of future values of TALT for given values of the factors (McClave and Benson, 610). The data used in this research only shows if each factor was or was not used in a specific procurement, therefore it has binary levels of "yes" or "no". The most appropriate type of statistical test to measure binary levels is the qualitative regression model (McClave and Benson, 610). Each of the variables in the regression model will have values of 1 or 0 to indicate if that factor was used in that procurement. Each of the variables are coded so that a larger coefficient would indicate an increase in TALT.

The regression analysis will tell us if the MIS system, alternate means of procurement, suspenses, competition, and socio-economic programs are statistically significant when correlated against TALT. The analysis will show direction of impact, if the factor increases or decreases TALT, as well as significance of each factor. This analysis does not show the magnitude of the correlation because it is qualitative in nature. The regression analysis only shows impact on the time from purchase request inception to time award, and

does not show impacts on distribution time for the award document nor the delivery time. This difference is because the data is not available for delivery times for manual purchase requests. Later in the analysis a proxy of the automated (Base/Medical Supply and GOCESS) will be used. This is explained in greater detail in the Proxy of Delivery section in this chapter.

Descriptive Statistics. In order to determine where the bottlenecks are in the process flow, TALT will then be parsed using descriptive statistics. For each phase, the internal lead times are collected to determine the mean and standard deviation.

Descriptive statistics will be used to show the usage of each of the factors by management information system and by base. This information will show how much of each of the factors is actually used. This will be useful to show the impact of the factor.

Descriptive statistics will also be utilized to assess the validity of the assumption that manual purchase requests are statistically equivalent to automated purchase requests. To accomplish this, the means and standard deviations are determined. Once this information is collected, the most appropriate test to compare the means of the two relatively large samples is the z-test which shows if there is a difference between the means (McClave and Benson, 392).

At the conclusion of the analysis of the descriptive statistics, the magnitude of each of the factors affect on TALT are known. Descriptive

statistics are used to show the usage of the socio-economic programs, competition, EDI, and suspensions. Descriptive statistics are also used to parse the elements of TALT. This means that the means and standard deviations are given for each phase in the procurement cycle, and responsibility are assigned to each part of the procurement process. Descriptive statistics are used for all phases of the procurement cycle, from time of purchase request inception to delivery of the end item.

Bonferroni Technique. The Bonferroni technique is utilized to determine if there is a difference in the mean delivery times when correlated against the size of the vendor. This aids in determining the impact of the socio-economic programs on TALT. By singularly examining the delivery times against the socio-economic program, any interaction effects with other factors is eliminated.

The Bonferonni Technique is also utilized to determine if there is a difference in the mean times of TALT for each of the MIS's. This comparison will quantitatively determine which of the MIS's has the greatest impact on TALT, either negative or positive.

For comparisons of means; also known as multiple comparisons, mean separation tests, multiple range tests, and tests for homogeneity of means, the statistical package determines if the means are significantly different from each other (Statistix, 1994, 210). The Bonferroni technique is the most common technique of multiple sample comparison of means. It is a method which



controls the experimentwise error rate of the Least Significant Difference Method (LSD) (Statistix, 1994, 210).

At the conclusion of the conclusion of the Bonferonni analysis, the impact of socio-economic program on delivery of an end item are known. This will show if the business classification has an impact on a firm's ability to perform on a purchase order. Also at the conclusion, the impact of the MIS's are known.

Proxy of Delivery. A proxy of the delivery of end-items is necessary because the availability of data is only available for automated customers. When a manual purchase request customer receives an item, a DD 250 or DD 1155 is used to show receipt of the item. This form is then sent to the Accounting and Finance Office for payment to the vendor. The Accounting and Finance system does not update the BCAS system to show the receipt date. On the other hand, when an automated customer, like Base or Medical Supply, receives an end item, their MIS updates the BCAS system. For this reason, to determine a true picture of the delivery times, a proxy using automated customers must be used to show what the delivery times for manual purchase request customers should be.

The delivery times for automated customers and manual purchase request customers is basically the same because the same vendors are typically used for both types of procurements, and both automated and manual purchase request customers procure such a wide variety of items, to make the mean delivery times equivalent.

The proxy for this study is delivery to automated customers (Base/Medical Supply and GOCESS). The time from purchase order award to receipt of the end item will be calculated. This number will be subtracted from the number of days that were expected for delivery to determine if the buys were ahead or behind of schedule. This time will be correlated against the socio-economic program to determine if the business classification has any impact on the ability to perform on a purchase order.

This proxy does provide one problem. The time from award in the BCAS system to receipt of an item is all considered to be delivery time. The processing time that the office takes to get the signed order to the vendor is mixed with this time. The different distribution times for the different MIS systems is not accounted. This data is, however, known from previous studies and by process analysis, and the total time can be corrected. The overriding majority of the items in the proxy were taken using the BCAS system, therefore it is taken as the baseline for the time from award to delivery. From this, the other MIS's have to subtract the distribution time from the delivery time to correct for this problem. In the BCAS system, it is known from a study at Brooks AFB that distribution time, including signing the award document, separating the forms, and mailing is 16 days (see Figure 2-8). For the BICEP MIS, this time is reduced to 1 day. For GATEC and MADES II, this time is immediate because the award transaction set is sent at the same time that BCAS is updated. For this reason, the BICEP time is reduced by 15 days, and the EDI MIS's are reduced by 16 days.

### Operationalization of Variables

The first step in the data analysis is to determine the TALT for purchase requests which meet the requirements of the theorized common process flow.

The data requirements is the following:

1. PR's in the Supply Branch

This requirement is selected to eliminate the Services and Construction Branches which account for a very small number of the total small purchase items awarded in an Operational Contracting Unit. It is desired to eliminate any variation due to Branch in order to focus on the Branch which accounted almost all of the line items.

2. Line items under \$25,000

This requirement is used to evaluate the effects on small purchase items only. As is indicated in the preceding limitation section, the TALT model created is only applicable to small purchase items which account for the majority of line items awarded by Operational Contracting. Since the data points selected are for the past year, many of which are before the full implementation of FASA, it was desired to eliminate any orders which were between \$25,000 and \$50,000 that could have been ordered as a large dollar contract.

3. Manual (AF Form 9) Customers

Only manual, or AF Form 9 Customers are selected because of the availability of data. This sample is believed to be representative because the "pipeline" nature of the requirements process is very similar as can be seen in Appendix B. To ensure the validity of the assumption, a statistical test will be utilized. This test is explained in greater detail later in this chapter.

4. Awards not made as a delivery orders against an existing contract (Award type "M" or "P").

Small purchase items are either purchased on a purchase order, or off of an existing contract as a delivery order. The vast majority of the items are procured as purchase orders. Existing contracts, either General Services Administration (GSA) contracts or local Indefinite Delivery Indefinite Quantity (IDIQ) contracts and large contracts take considerably longer than small purchase items. Since it is not desired to mix the TALT from awarding of the original contract with the TALT from the delivery order, the delivery orders were not included in this study.

5. Awards made not more than 13 months previously.

This requirement was added because the BCAS system purges all

records after 13 months. This restriction does not impact the results of the study because the 13 month restriction still gives a representative sample of the performance of the contracting office.

The restrictions placed on the data are to filter the purchase requests to meet the limits of this research. This filtering does not limit the results of the research, but rather limits the scope of the data to fit with the scope of the research.

A two step process is utilized in the analysis of TALT. First, the overall TALT for a random sample of the line items which meet the above criteria is determined. Second, the parsing of the TALT for each phase of the theorized process flow for the same random sample will be determined. The overall TALT is determined by subtracting the date of step 11, delivery of the end item, from the date of step 1, purchase request inception, in the theorized common process flow.

The parsing occurs by analyzing the dates between each of the phases. A measurement of the differences between the dates includes the action taking place in the process. For example, the difference between step 3 and step 2 is the difference between the date the funds were approved and the date the user received approval for the request, including the time that it took for the funding approval, not just wait time. A description of what these dates mean is found in Table 3-3.

Table 3-3. Meaning of Variables

	Beginning Step	Next Step	Formula	Meaning
1	User completes purchase request	User gets approval for request	$\Delta_{2-1} = \text{Step 2} - \text{Step 1}$	Time from user completion of AF Form 9 to when approved
2	User gets approval for request	User gets funds approved	$\Delta_{3-2} = \text{Step 3} - \text{Step 2}$	Time from approval of request to approval of funds
3	User gets funds approved	PR received by contracting	$\Delta_{4-3} = \text{Step 4} - \text{Step 3}$	Time from funds approval to PR receipt by contracting
4	PR received by contracting	PR reviewed by contracting	$\Delta_{5-4} = \text{Step 5} - \text{Step 4}$	Time from PR receipt to PR review by contracting
5	PR reviewed by contracting	PR put out for bids	$\Delta_{6-5} = \text{Step 6} - \text{Step 5}$	Time from review of PR to PR out for bids
6	PR put out for bids	Bids received by contracting	$\Delta_{7-6} = \text{Step 7} - \text{Step 6}$	Time from PR put out for bids to receipt of bids from contractor
7	Bids received by contracting	Award made to vendor	$\Delta_{8-7} = \text{Step 8} - \text{Step 7}$	Time from bid receipt to award of purchase order
8	Award made to vendor	Award sent to vendor	$\Delta_{9-8} = \text{Step 9} - \text{Step 9}$	Time from award to distribution of award
9	Award sent to vendor	Vendor receives award	$\Delta_{10-9} = \text{Step 10} - \text{Step 9}$	Time from award distribution to receipt of award by contractor
10	Vendor receives award	Vendor delivers item	$\Delta_{11-10} = \text{Step 11} - \text{Step 10}$	Time from receipt of award to delivery of end item
11	Vendor delivers item	Vendor paid for performance	$\Delta_{12-11} = \text{Step 12} - \text{Step 11}$	Time from delivery to payment

In order to operationalize these variables, the location of this information must be determined. The location of the information differs by MIS. **In cases where the information is not available, the cells are darkened.**

#### Operationalization of BCAS

For a typical Base Contracting Automated System (BCAS) office the information is listed as follows:

Table 3-4. Operationalization of BCAS Variables

Step Number	Description of Step	Location
Step 1	User completes purchase request	Inception date from Julian date in PR number on face of AF Form 9
Step 2	User gets approval for request	Approval date from face of AF Form 9
Step 3	User gets funds approved	Certification date from face of AF Form 9
Step 4	PR received by contracting	Date stamp by contracting on face of AF Form 9, also date entered into BCAS (both dates collected)
Step 5	PR reviewed by contracting	Manual review by contracting, data not collected
Step 6	PR put out for bids	Manual telephone calls, data not collected
Step 7	Bids received by contracting	Manual telephone calls, data not collected
Step 8	Award made to vendor	Award date in BCAS
Step 9	Award sent to vendor	Manual distribution of DD 1155, data not collected
Step 10	Vendor receives award document (DD 1155)	Manual receipt by contractor, data not collected
Step 11	Vendor Delivers item	Proxy of Base Supply items - See below
Step 12	Vendor paid for item	Information in Accounting system, data not collected

Discussion of Operationalization of BCAS. As indicated in table 3-4, BCAS and the face of the AF Form 9's do not contain all the information required to determine the parsing of TALT. For this reason, the parsing of TALT will combine process flow steps as indicated in Figure 3-1.

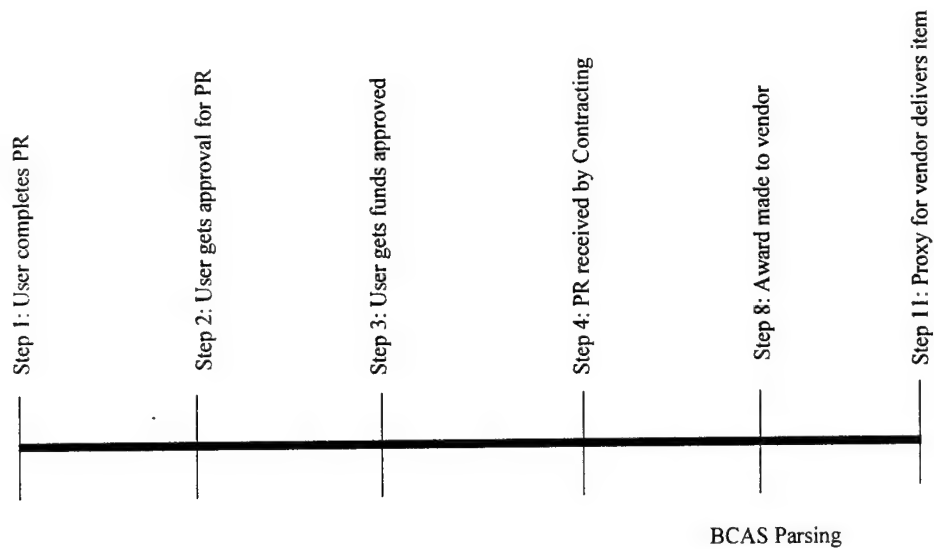


Figure 3-1. BCAS Parsing

Figure 3-1 indicates the date stamps which are available for analysis using the BCAS system. The parsing information is obtained by subtracting the dates to determine the time between each point. BCAS provides the least amount of information of any of the MIS's. Although this data is limited, it does provide information regarding possible bottlenecks in the process flow. The BCAS system is only utilized for reporting purposes to management, and the generation of DD 1155's. The intermediate dates are not recorded by the system, and therefore not available.

The blackened areas in table 3-4 limit the parsing in contracting from the time of receipt of the purchase request by contracting to award of the document. This still allows the total time responsibility for contracting, but does not show the internal processing times in the contracting office. The time from award through



vendor delivery are also not evaluated. A proxy of the delivery time is instead used, and explained in greater detail in the Proxy of Delivery Items section. In total, this data is still valuable because it shows the responsibility of the user, Accounting and Finance, Contracting, and the vendor. All that is lost is the internal processing times in the Contracting office.

### Operationalization of GATEC

The Government Acquisition Through Electronic Commerce (GATEC) utilizes Electronic Commerce/Electronic Data Interchange (EC/EDI), and therefore the solicitation of quotes is recorded in the system. The operationalization of the variables is as follows:

Table 3-5. Operationalization of GATEC Variables

Step Number	Description of Step	Location
Step 1	User completes purchase request	Inception date from Julian date in PR number on face of AF Form 9
Step 2	User gets approval for request	Approval date from face of AF Form 9
Step 3	User gets funds approved	Certification date from face of AF Form 9
Step 4	PR received by contracting	Date stamp by contracting on face of AF Form 9, also date entered into BCAS (both dates collected)
Step 5	PR reviewed by contracting	Manual review by contracting, data not collected
Step 6	PR put out for bids	GATEC system records date of transmission of EDI RFQ
Step 7	Bids received by contracting	GATEC system records date of receipt of vendor RFQ
Step 8	Award made to vendor	Award date in BCAS
Step 9	Award sent to vendor	GATEC system records date of transmission of electronic award
Step 10	Vendor receives award document (DD 1155)	GATEC system records date of receipt of electronic award by contractor
Step 11	Vendor Delivers item	Proxy of Base Supply items - See below
Step 12	Vendor paid for item	Information in Accounting system, data not collected

Discussion of Operationalization of GATEC. As indicated in Table 3-5, BCAS, GATEC and the face of the manual purchase request's contain more data for analysis. The parsing of TALT combines process flow steps as indicated in Figure 3-2.

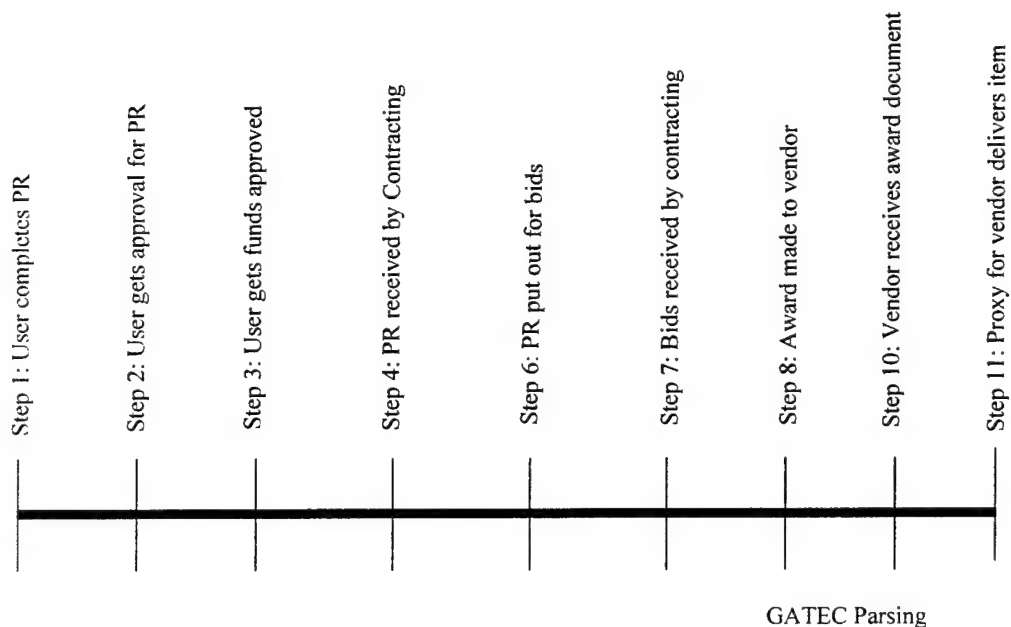


Figure 3-2. GATEC Parsing

Figure 3-2 indicates the date stamps which are available for analysis using the GATEC system. The parsing information is obtained by subtracting the dates to determine the time between each point.

The darkened blocks in Table 3-5 show that the only areas which are not to be studied are the review time by contracting and the vendor payment time. This means that in total, the responsibility for each phase of the procurement cycle

can be studied in the GATEC system, with the exception of the manual review of the purchase request.

### Operationalization of MADES II

The Menu Aided Data Entry System II (MADES II) system also utilizes EC/EDI, therefore the solicitation of quotes is recorded in the system. The operationalization of the variables is indicated in Table 3-6.

Table 3-6. Operationalization of MADES II Variables

Step Number	Description of Step	Location
Step 1	User completes purchase request	Inception date from Julian date in PR number on face of AF Form 9
Step 2	User gets approval for request	Approval date from face of AF Form 9
Step 3	User gets funds approved	Certification date from face of AF Form 9
Step 4	PR received by contracting	Date stamp by contracting on face of AF Form 9, also date entered into BCAS (both dates collected)
Step 5	PR reviewed by contracting	Manual review by contracting, data not collected
Step 6	PR put out for bids	MADES II records date of transmission of EDI RFQ
Step 7	Bids received by contracting	MADES II system records date of receipt of vendor RFQ
Step 8	Award made to vendor	Award date in BCAS
Step 9	Award sent to vendor	MADES II records date of transmission of electronic award
Step 10	Vendor receives award document (DD 1155)	MADES II records date of receipt of electronic award by contractor
Step 11	Vendor Delivers item	Proxy of Base Supply items - See below
Step 12	Vendor paid for item	Information in Accounting system, data not collected

Discussion of Operationalization of MADES II. As indicated in Table 3-6, BCAS, MADES II and the face of the manual purchase request's contains data

amounts equal to GATEC. The parsing of TALT combines process flow steps as indicated in Figure 3-3.

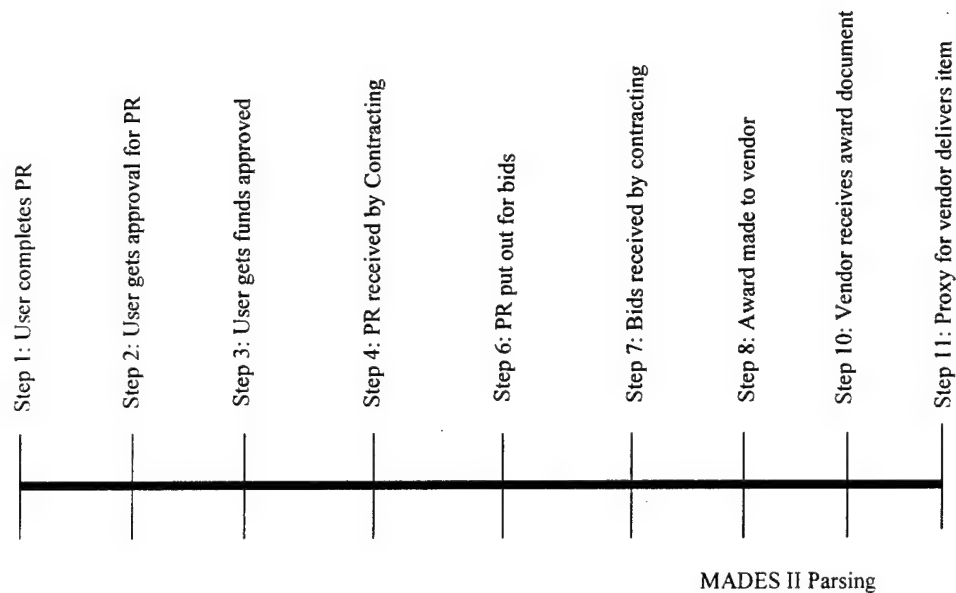


Figure 3-3. MADES II Parsing

Figure 3-3 indicates the date stamps which are available for analysis using the MADES II system. The parsing information is obtained by subtracting the dates to determine the time between each point.

The darkened cells in Table 3-6 show that in total, the same amount of information is available for GATEC as MADES II which will show responsibility for each phase in the procurement cycle, with the exception of the manual review of the purchase request and payment to the vendor.

#### Operationalization of BICEP

The BCAS Image Capability Enhancement Program (BICEP) system uses fax-out instead of the electronic data interchange, however the availability of the

data is similar to the EDI systems. The operationalization of the variables is indicated in Table 3-7.

Table 3-7. Operationalization of BICEP Variables

Step Number	Description of Step	Location
Step 1	User completes purchase request	Inception date from Julian date in PR number on face of AF Form 9
Step 2	User gets approval for request	Approval date from face of AF Form 9
Step 3	User gets funds approved	Certification date from face of AF Form 9
Step 4	PR received by contracting	Date stamp by contracting on face of AF Form 9, also date entered into BCAS (both dates collected)
Step 5	PR reviewed by contracting	Manual review by contracting, data not collected
Step 6	PR put out for bids	BICEP fax transaction log records date of transmission of faxed written RFQ
Step 7	Bids received by contracting	Vendor quotes are automatically printed, the date of the vendor quote is not available
Step 8	Award made to vendor	Award date in BCAS
Step 9	Award sent to vendor	BICEP fax transaction log records the date of transmission of the image DD 1155
Step 10	Vendor receives award document (DD 1155)	The receipt of the DD 1155 by the contractor is always concurrent to BICEP sending, therefore data not collected
Step 11	Vendor Delivers item	Proxy of Base Supply items - See below
Step 12	Vendor paid for item	Information in Accounting system, data not collected

Discussion of Operationalization of BICEP. As indicated in Table 3-7, BICEP has an equal amount of useful data as the EDI sites with the exception of the vendor response to the Request for Quotation (RFQ). The parsing of TALT combines process flow steps as indicated in Figure 3-4.

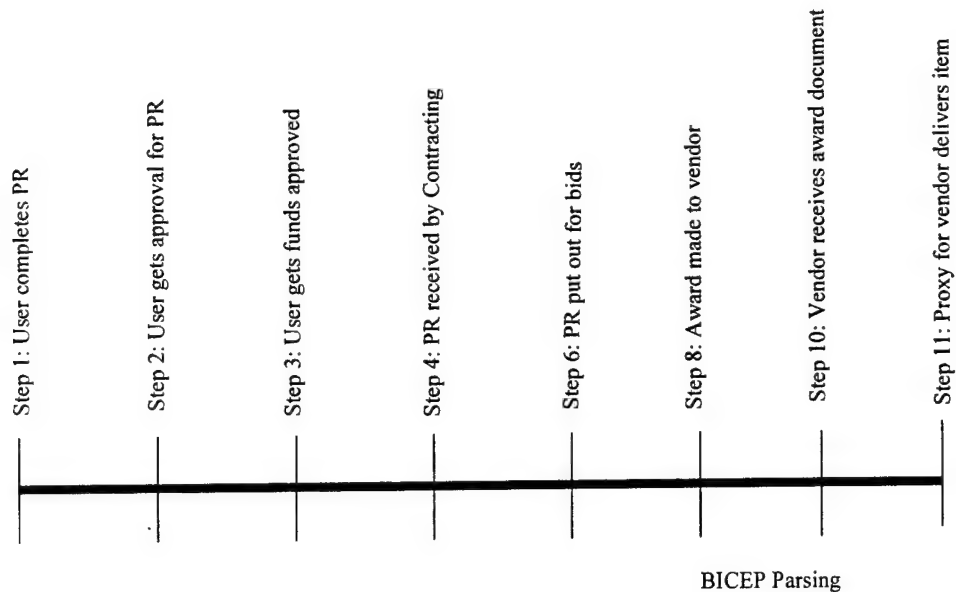


Figure 3-4. BICEP Parsing

Figure 3-4 indicates the date stamps which are available for analysis using the BICEP system. The parsing information is obtained by subtracting the dates to determine the time between each point.

The darkened cells in Table 3-7 show that the review time for contracting, time for vendor quotation, time for receipt of the purchase order, and payment times are not available for the BICEP system. This means that responsibility for pre-contracting activities will be known, and that only limited internal responsibility for contracting will be known, but total contracting time can still be established. The main item which will be lost is the time for vendor quotation, but this time is already set by procedure as 5 days to allow the vendor to quote on an item. In sum total, BICEP will still reveal enough information to make an analysis of the internal processing times for the procurement cycle to be useful.

### Location of Data

The data for each of the research questions is found through the various MIS's. The operationalization of these factors is described in Table 3-8. **The factors in gray are those factors which can not be determined or can only be determined indirectly.**

Table 3-8. Operationalization of Factors

Factor	Meaning	Location of Data
Management Information System	If the MIS used was BICEP (Brooks), GATEC, MADES II, or BCAS	The respective MIS systems will indicate which system was utilized for procurement.
Alternate Means of Procurement	Only the centralized EC/EDI will be studied in this thesis	An MIS inquiry will indicate if the item was purchased using EC/EDI
Buyable Purchase Requests	If the purchase of the item was delayed because of missing data	BCAS report showing number of days suspended
Customer Access to Information	If the customer had access to information	Only BICEP grants access. This factor will be mixed with the MIS factor, not directly measured
Funding Issues	If funding had an impact on the requirement	The only part of this factor which can be determined is the amount of time required for funding
Accelerated Coords	The impact of accelerated coordinations on TALT	This factor will be examined in the analysis of the TALT means
Purchase of off-the shelf	The impact of purchasing items which are not off-the-shelf	This factor can be analyzed by studying the stock class. Since developmental items are typically over 25K, it is not examined
Use of socio-economic	The impact of socio-economic programs on TALT	The vendor type in BCAS award file
Regulatory	Regulations and laws must be overcome and can not be changed	Will impact overall efficiency of process, only look at if the purchase was competitive (BCAS award file)

### Conclusion

In Chapter 2, the nine factors were created in the model, and described to affect Total Acquisition Lead Time (TALT). Chapter 3 describes the methodology for the analysis. After data collection, statistical tests are used to determine if these factors do affect TALT. The data collection takes place at 5

different sites. The bases are of different sizes, locations, commands, and functions to allow for broad generalizations.

After the data collection takes place, statistical analysis is necessary to determine the effects of the factors on TALT. The first statistical test is the qualitative regression analysis. This test indicates the statistical significance of each factor on TALT. After the regression analysis demonstrates the significance, descriptive statistics are used to determine the usage of each of the factors and to parse, or separate the time within TALT to assign responsibility. The final part of the statistical test is the Bonferonni Technique which will be used to determine if there is a difference in the mean processing times for the different management information systems. The Bonferonni Technique will also be used to determine if there is a difference in the mean delivery times for different socio-economic programs.

At the conclusion of this analysis, generalizations can be made about the factors. These generalizations can be used to for future research and in development of regulation, process flows and management information systems.

In Chapter 4, the results of this study will be explained, and any unexpected answers will be rectified. In Chapter 5, the conclusions which can be drawn from the results will be explained.



## 4: Analysis of Data

### Background

In Chapter 3, the methodology for data collection and analysis is established, the variables are operationalized, and the statistical methods for analysis are described. In Chapter 4, the data collection and statistical analysis are reported. In Chapter 5, the conclusions which can be drawn from Chapter 4 are discussed.

Chapter 4 starts with a regression analysis of the data collected to determine which qualitative factors in the theorized model from Chapter 2 do affect TALT. Descriptive statistics are then utilized to parse the information which is found to be statistically significant. Finally, a Bonferroni Technique using and Analysis of Variance is then used to determine the effect of socio-economic program and base on the delivery of items to the bases.

### Validation of Assumption

One assumption which is made concerning the sample is that manual purchase requests, or AF Form 9's, are equivalent to automated customers, base supply, medical supply, and GOCCESS/COCCESS. To test this assumption, a z-test is necessary. There is some concern that collecting data only on AF Form 9's and relating those results to all small purchases is not be valid because of possible differences in process flows within the contracting office. To

determine if this fundamental assumption is valid, a Z-test is utilized. The average time for processing AF Form 9 actions is compared against the average time to process an automated action. The test is as follows:

The null and alternate hypotheses were:

$$H_0: (\mu_1 - \mu_2) = 0$$

$$H_a: (\mu_1 - \mu_2) > 0$$

where

$\mu_1$  = the mean time to process an AF Form 9

$\mu_2$  = the mean time to process an automated action

The Z test was:

$$z = \frac{(\bar{x}_1 - \bar{x}_2)}{\sigma_{(\bar{x}_1 - \bar{x}_2)}}$$

where

$$\sigma_{(\bar{x}_1 - \bar{x}_2)} = \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

and the sample sizes are sufficiently large (greater than 30) so that  $\mu \approx \bar{x}$ .

$$z = \frac{(13.25 - 9.75)}{\sqrt{\frac{(23.16187)^2}{101} + \frac{(9.54)^2}{3543}}} = .6554$$

The rejection region is  $z > z_\alpha$

Since  $z$  was not greater than  $z_\alpha$ , we do not reject the null hypothesis and it can be concluded that the difference between the means is not statistically significant. The conclusion is that the assumption that automated and manual purchase request processing is equivalent, is valid.

### Statistical Analysis

The first statistical tool utilized is a regression analysis. The regression model is the following:

$$E(y) = \beta_0 + \beta_1 MIS1 + \beta_3 MIS3 + \beta_4 MIS4 + \beta_6 MIS6 + \beta_7 ALT + \beta_8 SUS + \beta_9 SOC1 + \beta_{10} SOC2 + \beta_{11} SOC3 + \beta_{12} COMP$$

where:

$E(y)$  = TALT

$\beta_0$  = Constant

$\beta_1$  = Coefficient on BICEP

MIS1 = Level 1 for BICEP

$\beta_3$  = Coefficient on GATEC

MIS3 = Level 3 for GATEC

$\beta_4$  = Coefficient on MADES II

MIS4 = Level for MADES II

$\beta_6$  = Coefficient for BCAS

MIS6 = Level for BCAS

$\beta_7$  = Coefficient for Alternate Means of Procurement

ALT = Level for Alternate Means of Procurement (1=EDI, 0=non-EDI)

$\beta_8$  = Coefficient for Buyable Purchase Request

SUS = Level for Buyable Purchase Request (1=Suspended, 0=not Suspended)

$\beta_9$  = Coefficient for Socio-Economic Program (L)

SOC1 = Level for Socio-Economic Program (L)

$\beta_{10}$  = Coefficient for Socio-Economic Program (S)

SOC2 = Level for Socio-Economic Program (S)

$\beta_{11}$  = Coefficient for Socio-Economic Program (O)

SOC3 = Level for Socio-Economic Program (O)

$\beta_{12}$  = Coefficient for Regulatory

COMP = Level for Regulatory (1=Competitive 0=Not Competitive)

A regression analysis was completed using SPSS for Windows, Student Edition. The results of this regression were as follows:

Table 4-1. Results of Regression Analysis

Variable	B	SE B	95% Conf Intrvl B		Standard Beta
COMP	4.028331	6.601886	-8.942590	16.999251	.026613
MIS1	2.083518	4.890320	-7.524638	11.691673	.017968
MIS3	27.682806	4.828211	18.196677	37.168935	.244978
MIS4	9.765512	8.476827	-6.889159	26.420183	.047856
SOC1	-.549979	4.817124	-10.014325	8.914366	-.005025
SOC3	1.466263	3.664277	-5.733050	8.665576	.016814
SUS	23.674870	5.060703	13.731957	33.617783	.198591
(Constant)	19.352986	6.646923	6.293582	32.412390	
Multiple R	.40749				
R Square	.16605				
Adjusted R Square	.15268				
Standard Error	31.82842				
Analysis of Variance					
	DF	Sum of Squares	Mean Square		
Regression	8	100652.28514	12581.53564		
Residual	499	505511.18533	1013.04847		
F =	12.41948	P-value = .0000			

To determine the significance of the variables, the p-value is analyzed.

The p-values are listed below.

Table 4-2. P-values of Factors

Variable	Tolerance	VIF	T	P-Value
COMP	.878534	1.138	.610	.5420
MIS1	.939688	1.064	.426	.6703
MIS3	.915449	1.092	5.734	.0000 *
MIS4	.968477	1.033	1.152	.2499
SOC1	.862714	1.159	-.114	.9091
SOC3	.946583	1.056	.400	.6892
SUS	.927413	1.078	.678	.0000 *
(Constant)		2.912	.0038	

\* indicates significant at  $p < .05$

Starting with Table 4-1, the first column is the variable name; MIS1 is BICEP, MIS3 is GATEC, MIS4 is MADES II, MIS6 is BCAS, COMP is competition, SOC1 is large business, SOC2 is small business, SOC3 is small business with another designator, ALT is alternate means of procurement (EDI). The second column, labeled B, is the coefficient, or slope of the line which plots the TALT against the factor (McClave, 460:1994). The third column, labeled SE B, is the standard error of the coefficient. This can be equated to the standard deviation of the coefficient term (McClave, 460:1994). The Fourth and Fifth columns of numbers are the 95% confidence interval. It is 95% confident that the Beta term in column 2 lies between the two numbers in the confidence interval (McClave, 460:1994). The last column, labeled standardized Beta, is the standardized coefficient. This is the coefficient, or slope of the line, when all of the variables are put into z-score form (McClave 233:1994). The last row in the

table is the constant term which is equated to the y-intercept of the line (McClave, 460:1994).

In the row under the coefficient data is the adjusted R square, or coefficient of determination, which represents the fraction of the sample variation of the TALT which is attributable to the regression model (McClave, 546:1994). In this case, 15.27% of the variability in TALT is attributable to the factors in the regression model. The final number in the table which shows significance is the F-value. The p-value next to the F-value shows if the entire model is significant. If the p-value is less than alpha, in this case .05, the entire model is significant. For this model, the p-value is 0.00, therefore the entire model is significant.

In table 4-2, the p-values for each factor is shown. When the p-value is less than alpha, in this case .05, the factor is significant. For this model, the factors which are significant are MIS3 (GATEC), and SUS (suspensions). MIS6, ALT, and SOC2 were not included in the regression model because of high correlation's in the model. This will be explained in each respective question below.

The r squared value indicates the amount of variance that the model was able to account for. In this model, 15.268% of the variance, or change, in TALT was attributable to the factors in the model. In this type of qualitative analysis, this percentage is acceptable, but means that 84.6% of the variance in TALT is attributable to factors outside of this model.

### Research Questions

Each research question will be answered using the statistical tests explained in Chapter 3. The results are as follows:

Q1. How does the use of socio-economic programs correlated with TALT.

This question is studied in three different ways. First, the regression analysis is used to determine, qualitatively, if there is a correlation between the business type, either large, small, or other socio-economic program, with TALT. The p-value in the regression output determines if the factor is significant, and the sign identifies if the factor has a positive or negative correlation with TALT. The regression analysis only shows the correlation between the socio-economic program and the TALT-del, or the time from purchase request inception to time of award in the BCAS system.

The regression analysis indicates that none of the vendor classifications are significant at alpha equal to .05 for the period between purchase request inception to award in the BCAS system. For SOC1, which indicates large businesses, the p-value is .9091 which shows that the factor is not significant. For SOC3, the factor which includes all small businesses with another socio-economic program, the p-value is .6892, which shows that the factor is not significant. SOC2, which indicates small business was not included in the model by SPSS because it was too highly correlated with other factors to include in the model. The conclusion which can be drawn from this is that the business type,

or socioeconomic program, has no effect on the TALT from the time of purchase request inception to award in the BCAS system. This means that small businesses, small businesses with another designator, and large businesses, are all equally responsive when bidding on small purchases. The over-riding conclusion is that contracting can, in general, rely on all business types equally to be responsive in the bidding process.

The second step in the analysis of this question uses descriptive statistics to show the usage of each type of socio-economic program for each MIS. This breakout analysis helps to show, quantitatively, the magnitude of the usage of each type of program, but will not show the impact of the programs on TALT.

Table 4-3. Socio-Economic Program Usage (MIS Breakout)

	Socio PGM			
	BICEP	BCAS	GATEC	MADES II
%W	4.08%	9.76%	13.21%	6.25%
%V	2.04%	2.36%	11.32%	18.75%
%T	0.00%	2.36%	1.89%	12.50%
%S	75.51%	72.05%	75.47%	56.25%
%M	2.04%	3.03%	0.00%	0.00%
%L	16.33%	10.44%	0.00%	0.00%

The different letters in the table indicate different socio-economic classifications; W indicates woman owned small business, V indicates a woman owned disadvantaged business, T indicates a disadvantaged business, S indicates a small business, M indicates a non-profit organization, and L indicates a large business. Showing the usage of socio-economic programs is important because if all types of businesses are responsive in the bidding process, Contracting can utilize different socio-economic programs to attain the



goals of Congress for business utilization without concerns about affecting the pre-award portion of contracting.

The third step in the analysis is to show the impact of socio-economic program on delivery of items. This is accomplished by using an Analysis of Variance with the Bonferroni Technique. This technique shows grouping of the small, large, and other socio-economic program, to show if there is a difference in the means of any of these programs. Since the information about the delivery of the items is not available for AF Form 9 actions, a proxy for vendor delivery is utilized as was described in Chapter 3. Using 100% sampling, there are 12,523 data points. The mean delivery time for routine requests is the following:

Table 4-4. Mean Delivery Times

ave (days)	32.15
std dev	34.96
size	12523

This analysis also determines the effect of the individual base and socio-economic programs on TALT. To determine the impact of socio-economic program on delivery, a random sample of 1500 data points was taken, and a Bonferonni test was completed. Since different types of items have different delivery times, it is more meaningful to determine the difference between when the Government expected an item and when the Government actually received an item. The results are as follows:

Table 4-5. Analysis of Delivery by Vendor

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	167	.2695	36.0594	2.7904	-5.2397	TO	5.7786
Grp 2	965	7.6528	40.2681	1.2963	5.1090	TO	10.1967
Grp 3	322	-3.3820	41.0922	2.2900	-7.8872	TO	1.1233
Total	1454	4.3611	40.2469	1.0555	2.2906	TO	6.4315

Table 4-5 shows the analysis of variance for the three groups of vendors. Grp1 is large business, Grp 2 is small business, Grp 3 is small business with another designator. The second column is the count, or number of occurrences that the type of business was in the sample of 1454. For example, there were 167 occurrences of large business. The third column is the mean delivery time. This is the number of days that each type of business was ahead or behind of schedule in the delivery of an item. Large business were on average, .2695 days late on delivery of end items, small businesses were, on average, 7.6528 days late on delivery, small businesses with another designator were, on average, 3.3820 days early on delivery of end items. The fourth column is the standard deviation of the mean. The fifth column is the standard error in the analysis of variance. This can be equated to the standard deviation of the coefficient if this were a regression model. The sixth and seventh columns are the 95% confidence interval. This means that there is 95% confidence that the mean will fall between these numbers.

To determine if there is any statistical difference between the means, the Bonferroni Technique resulted in the following:

Mean	VENDOR
-3.3820	Grp 3
.2695	Grp 1
7.6528	Grp 2 *

Figure 4-1. Bonferroni Technique for Socio-Economic Programs

The star in the box indicates that Grp 1 and Grp3 were in a single grouping, and that Grp2 was in a separate grouping. This test shows that small businesses without a designation are not as able to deliver items at the requested times as consistently as large businesses or small businesses with another socio-economic designator.

The conclusion which can be drawn from these results is that in the pre-award phase, all of the businesses are as responsive, on the average. In the post-award phase, large businesses and small businesses with another socio-economic designator are more able to perform on the purchase order than small businesses without another socio-economic designator, by seven to ten days on average.

In summary, the regression analysis shows that socio-economic programs do not affect TALT for the pre-award phase of the process. The Bonferonni Technique shows that socio-economic programs do affect performance on the purchase order for the post-award phase, and that large

businesses and small businesses with another designator are more able to perform than small businesses without another designator.

Q2. How do regulatory requirements affect TALT?

Since regulatory requirements are so pervasive in government contracting, it is difficult to parse the regulatory factor from other factors. For the purposes of this research, only one aspect of regulation is considered, competition. To determine the effect of competition, a two step approach is utilized. The regression analysis is used to determine the significance of competition on TALT, and the sign of the coefficient shows the direction of the impact of competition on TALT. After the significance is determined, descriptive statistics will be utilized to determine the usage of competition for each MIS. The descriptive statistics show the magnitude of usage of competition for each MIS, but do not show the correlation of competition on TALT.

The regression analysis indicates that the variable COMP, for competition, is not significant, with a p-value of .5420. This means that the use of competition does not affect TALT. This is an important finding because it is widely believed in the procurement field that the use of competition increases the time that it takes to award a purchase order. These findings indicate that purchase orders which are awarded competitively are just as fast, or slow, as those which are non-competitive actions. The results can be carried over into customer training, where users are concerned that that the use of competition for small purchase actions increases the amount of time which it takes for processing the award.

The statistics for each MIS indicate the usage of competition, parsed by each MIS. The percentages in the table indicate the percentage of competitive actions for each type of MIS.

Table 4-6. Competition (MIS Breakout)

	Competition			
	BICEP	BCAS	GATEC	MADES II
%	95.92%	92.93%	100.00%	100.00%

Competition is the only portion of regulation which is measured. As these results indicate, the vast majority of actions are competitive. The results from the regression analysis indicates that high utilization of competition will not necessarily increase the processing time of orders. The answer to this question is that one aspect of regulation, being competition, does not affect TALT.

Q3. How do alternate means of procurement impacted TALT?

There are three main alternate means of procurement, the IMPAC card, decentralized BPA's, and Electronic Commerce (EC). Since the IMPAC card and decentralized BPA's are not handled directly through the contracting office, the impact of the decentralized purchases is not able to be determined. The impact of EC, however, is able to be determined. This one aspect of alternate means of procurement is studied in two steps. The first step is the regression analysis which shows, qualitatively, if there is a significant impact on TALT. The p-value indicates if the factor is significant. The sign of the coefficient indicates the direction of the impact. It does not make sense to provide descriptive

statistics on the usage of EDI broken out by MIS because MADES II has 100% usage, GATEC has 100% usage, and all other systems have 0% usage. The breakout by base is provided at the end of the chapter.

The information is collected through an inquiry into the AwardPR file in the BCAS system to determine if EC/EDI was utilized. At all sites, if MADES II is utilized, the project title field indicates "MADES II AWARD". For Wright Patterson, it is determined if GATEC is utilized because a separate branch is used in the Branch field.

SPSS did not include the variable for ALT because it was too highly correlated with MADES II and GATEC to have enough variability to measure. All MADES II and all GATEC actions are EDI actions, and conversely all BCAS and BICEP actions are not EDI actions. For this reason, all conclusions which can be drawn about EDI must be taken from the MIS portion of this analysis. To answer this question, question 7 must first be answered.

Q4. What is the impact of the contracting office receiving purchase requests which are not adequate for purchase?

This question will be answered in two parts. First it will be analyzed qualitatively through the regression analysis. The p-value shows significance and the sign shows direction of impact on TALT. The second step is through the descriptive statistics to show the impact of MIS on suspensions of PR's by indicating the percentage of purchase requests which are suspended in the BCAS system.

This information is located in the AwardPR file in BCAS which indicates the number of days that a purchase request is suspended in the BCAS system. This time is not normally counted against a contracting office when computing statistics about performance.

The regression analysis shows that SUS, the variable for suspensions is significant, with a p-value of 0.00. The sign on the coefficient, approximately 23.67, shows that the direction of the effect of suspensions is to increase TALT. When a purchase request is suspended in BCAS, it increases TALT.

The MIS breakout shows the numbers of suspended purchase requests for each MIS.

Table 4-7. Suspensions (MIS Breakout)

		Suspense		
	BICEP	BCAS	GATEC	MADES II
%	4.08%	6.06%	16.98%	0.00%

The percentages in the chart indicate the total percentage of purchase requests which do not contain enough information to be purchased when they are received by contracting, or not enough information from the vendor to process the award. A suspension "stops the clock" in the contracting system.

The conclusion from the analysis of this factor is that suspended purchase requests negatively impact TALT. This is expected because the small purchase process is a pipe-line process, anytime there is a delay in the process, the entire process is delayed. The only way to decrease the impact of this factor is through

customer education to ensure that purchase request packages are complete when they are received by Contracting.

The answer to the question is that suspended purchase requests do affect TALT, but that with the exception of GATEC, all systems had a suspense rate of 6% or less. The reason for the high suspense rate in GATEC can either be traced to customer training, or the use of EDI, where the vendors are not providing enough information when they send quotations back to the contracting office to process the award, and will be studied in greater detail in the Base Breakout Section in this chapter.

Q5. How does automated access to information affect TALT?

This answer can not be directly measured because only one MIS allows automated customer access, BICEP. Since BICEP is the only system which allows access to information by the resource managers, it is impossible to determine if reductions are the result of BICEP as an MIS, or access to information, because there is no variance to measure. For this reason, this question is not directly addressed, but rather is mixed with Question 7.

Q6. How do Funding Issues affect TALT?

There are a variety of funding issues described in Chapter 2. The only funding issue which can be quantitatively determined is the impact of certification of funds on purchase requests by the Accounting and Finance Office. The impact on the certification of funds can be measured by parsing the times



throughout the funding cycle. The impact is measured by subtracting the time from receipt of the purchase request by accounting and finance to the time of receipt by contracting.

Table 4-8. BCAS Accounting and Finance Impact

ACCT Date		Cert Date		KT Receipt	Total
Days	2.6		2.4		5.0
Sample	66		122		113

This table shows the results for the only MIS which is able to give the information about Accounting and Finance, BCAS. It shows that from the time of the purchase request is received at Accounting and Finance to the time it is received by Contracting, was 5.0 days, on average, for all BCAS sites. Because the small purchase process is a "pipeline process", or all activities occur in a sequential manner, that Accounting and Finance accounted for 5 days in the procurement cycle. The other MIS's show the time from purchase request inception to the time of BCAS entry.

Table 4-9. GATEC Accounting and Finance Impact

Inception		BCAS Ent	Total
ave	41.79		41.79
size	53		53

Because it was not possible to retrieve the purchase requests at the GATEC site, specific information about Accounting and Finance is not available. This table shows the time from purchase request inception to the time of BCAS

entry. This time is used for coordinations, Accounting and Finance certification, and hand-carrying purchase requests to contracting. As can be seen from the table, this accounts for approximately 42 days of the procurement cycle when using the GATEC system. The MADES II sites also only has the information from purchase request inception to entry into the BCAS system

Table 4-10. MADES II Accounting and Finance Impact

Inception		BCAS Ent	Total
ave	14.4		14.4
size	15		15

The purchase requests are not available for MADES II purchases, therefore the specific information is not available for Accounting and Finance. As is indicated in the table, from purchase request inception to entry into BCAS, the average time is 14.4 days. This time includes all coordinations, Accounting and Finance certification and having the purchase request hand carried to Contracting. This time is much less for MADES II than for GATEC, for the same time period. Since the contracting MIS does not impact any times prior to receipt by contracting, the differences must be attributable to differences at specific bases. This is explored in greater detail in the Base Breakout, later in the chapter.

Table 4-11. BICEP Accounting and Finance Impact

Inception		BCAS Ent	Total
ave	14.68		14.68
size	50		50

The date stamps on the face of the AF Form 9's are not legible on the scanned images of the BICEP purchase requests, making the only measure from purchase request inception to entry into the BCAS system. The time from purchase request inception to entry into BCAS is approximately 15 days, which includes coordinations, Accounting and Finance certification, and hand-carrying the purchase request to Contracting. This time is consistent with the time seen in the MADES II MIS.

Since the contracting MIS does not directly impact any time prior to receipt of a purchase request by Contracting, differences due to MIS's are actually attributable to differences at individual bases. These differences are more apparent in the Base Breakout later in the chapter. The only system which actually showed certification of funds as a separate factor was the BCAS system. This system does show that Accounting and Finance certification of funds increases TALT, and that any automation techniques which speeds certification has a corresponding decrease in TALT.

The conclusion which is drawn from these results is that Accounting and Finance does impact TALT. Only one of the MIS's is able to show the direct impact of certification of funds on TALT because of availability of data. The other systems have the information mixed with other times, all of which are before receipt of the purchase request by contracting. This information is still

useful because it shows the pre-award time which is the responsibility of offices other than Contracting. Any reduction in any part of the pre-Contracting pipeline has a corresponding reduction in TALT. The answer to this question is two part, for BCAS sites, Accounting and Finance certification of funds increases TALT by 5 days. The second part of the answer relates to Accounting and Finance, the user, and coordination points. The pre-contracting phase of the procurement, or Pre-CALT, is approximately 14 days of the TALT for BICEP and MADES II awards, and approximately 42 days of the GATEC TALT.

Q7. Do different Management Information Systems (MIS) affect TALT differently?

The results from the regression analysis show the coefficients for the five different MIS's; MIS1 represents BICEP, MIS3 represents GATEC, MIS4 represents MADES II, and MIS6 represents BCAS.

SPSS did not include MIS6(BCAS) in the model because it is too highly correlated with the other MIS systems. This high correlation is understandable because BCAS is in place at all sites in the Air Force. While the coding scheme separated awards made on other systems as non-BCAS, the statistics came out with high correlations. For this reason, we can take BCAS as our base-line for time from purchase request inception to award of the document. MIS1 (BICEP) was not statistically significant, with a p-value of .5420. This means that BICEP did not increase or decrease TALT for the period between purchase request inception to award in BCAS. For this reason, BICEP is considered equivalent to

the baseline, BCAS. MIS4 (MADES II) is not statistically significant, with a p-value of .2499. The reason for this is the low utilization of MADES II awards for AF Form 9 Actions. For the entire sample of 520, there were only 15 MADES II awards. This low utilization did not provide enough variability to be statistically significant. It is believed that as EDI awards increase as implementation increases, this factor will become significant. The regression model shows that MIS3 (GATEC) is the only MIS which significantly impacts TALT for the pre-award phase of contracting, with a p-value of 0.00. The coefficient shows that the direction of the impact is to increase TALT for the pre-award phase of the procurement. The incremental savings in time that are seen in the post-award phase will be explained later in the chapter. The second part of this analysis shows how this impacts TALT.

The first portion of the MIS breakout shows the time from purchase request inception to date of input into the BCAS systems, or pre-CALT, for each system used at data collection sites.

Table 4-12. Pre-CALT (MIS Breakout)

	Pre-Calt			
	BICEP	BCAS	GATEC	MADES II
Days	14.68	14.29	41.79	14.4
St Dev	29.39	17.97	63.67	7.79

As is indicated by Table 4-12, all of the Pre-CALT, or the time prior to the receipt of a purchase request at Contracting, times are similar except GATEC, which is almost three times as large as the other systems. The reason for this is

not directly known because GATEC as a system does not deal directly with any pre-contracting activities, but must be related to the specific base.

The second portion of the Base Breakout is the Contract Administrative Lead Time (CALT). This time is measured from receipt of a purchase request by contracting to award of the purchase request..

Table 4-13. CALT (MIS Breakout)

		CALT		
	BICEP	BCAS	GATEC	MADES II
Days	16.82	10.44	13.68	14.4
St Dev	12.42	16.14	10.28	7.79

The CALT times for GATEC and MADES II both include the mandatory 5 day wait time for EDI transactions. Actual processing time should be reduced by 5 days for both of these systems to calculate the time that contracting is actively working the purchase requests. The time in Table 4-12 is accurate from the user's perspective, however, for the amount of time that contracting is processing the order and reflects the actual time from receipt by contracting to award of the purchase order by Contracting.

The third portion of the MIS Breakout is Total Acquisition Lead Time (TALT) minus the delivery time.

Table 4-14. TALT-Delivery (MIS Breakout)

		TALT-Del		
	BICEP	BCAS	GATEC	MADES II
Days	26.08	24.73	55.47	33.73
St Dev	12.53	24.69	61.69	15.54

The Total Acquisition Lead Time minus the delivery time, TALT-del, overstates the true time-frames for three of the systems because of the measurement method. These times measure the total time from purchase request inception to contract award. The processing time immediately after award is not accounted for in this measure. In the BICEP system, the distribution time is reduced because the purchase order is faxed to the vendor instead of using the U.S. Postal Service. This cuts up to 2 weeks of processing time because of the reduction in handling within the office and mail time. For GATEC and MADES II, the purchase order is electronically sent to the vendor as a transaction set, so the same reduction in processing time is seen. This will be explained in greater detail later in this section.

BCAS Parsing of TALT. The first system to study, or parse the elements of TALT is BCAS.

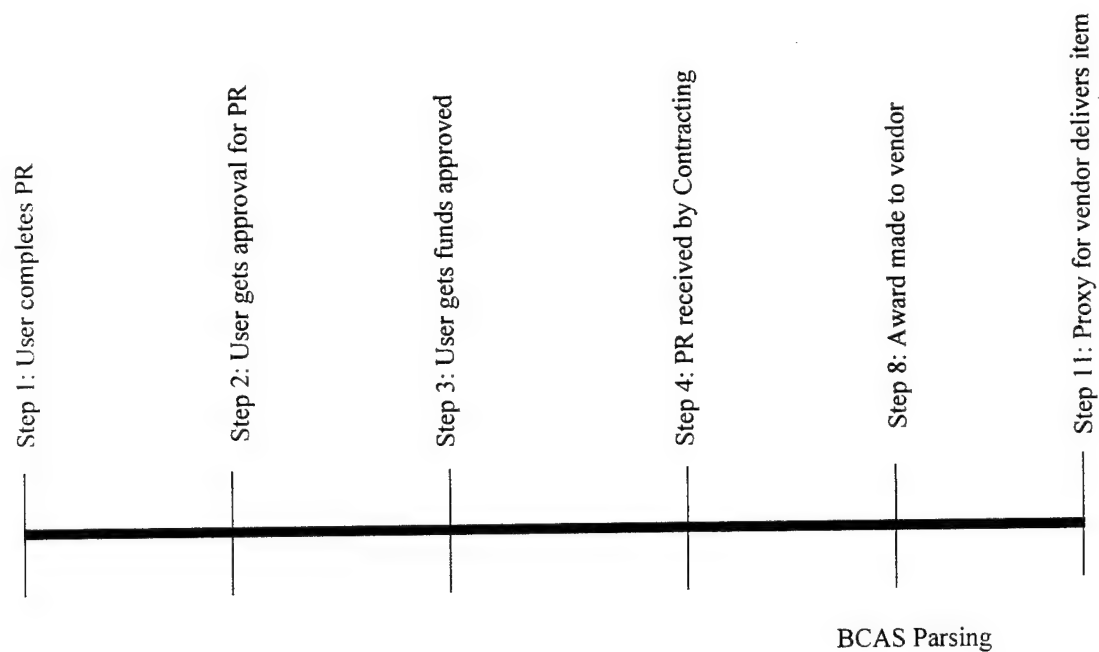


Figure 4-2. BCAS Parsing

Table 4-15. BCAS Parsing

User Start	ACCT Date	Cert Date	KT Receipt	BCAS Entry	Award Date	1155 Out
ave	4.1	2.6	2.4	1.5	10.4	6.2
sd	6.7	4.8	5.6	3.8	16.1	7.7
size	59	66	122	113	113	43

Table 4-15 shows the amount of time between each step in the procurement process, through receipt of the DD11555 by the contractor. The delivery time for the item is measured separately. The chart shows the average number of days, standard deviation, and the number of data points containing information.



Figure 4-2 shows the steps which were intended to be analyzed in the parsing. Some variation was necessary due to differences found in the data collection. The first data collection difference was that step 1 and step 2 were consistently the same on the AF Form 9's. This indicates that resource managers put the same dates for the completion of the form and the approval of the form, even if the dates were not actually the same. This difference makes data analysis meaningless for this difference in time.

Table 4-15 shows that an additional step is added to show the difference in accounting date and certification date. This time was expected to be minimal, and therefore not necessary to collect. After analysis of the forms, it was determined that the time from receipt of the form by Accounting and Finance and the actual certification by the certifying official was more than insignificant, therefore it was collected, and shows the time from receipt of the purchase request by Accounting and Finance and certification of funds by Accounting and Finance.

It was expected that the date a purchase request was received by contracting and the date the purchase request was entered into the BCAS system would be insignificant. After analysis of the purchase request, the time was more than insignificant, therefore the data was collected, and shows the amount of time that the purchase request waited in contracting before it was entered into the BCAS system.

Another measure that was not expected to be collected was the difference between the award date and the date that the 1155 was received by the vendor.

This time was only collected for those purchase requests at Brooks Air Force Base which did not use BICEP in the procurement process, but did use the procedure to fax a copy of the DD 1155. This time indicates the review and signing of the purchase order, scanning of the document and faxing, and shows pure administrative time at Brooks Air Force Base.

GATEC Parsing of TALT. The GATEC system shows more information about the internal processing of purchase requests. The intended data collection was as follows:

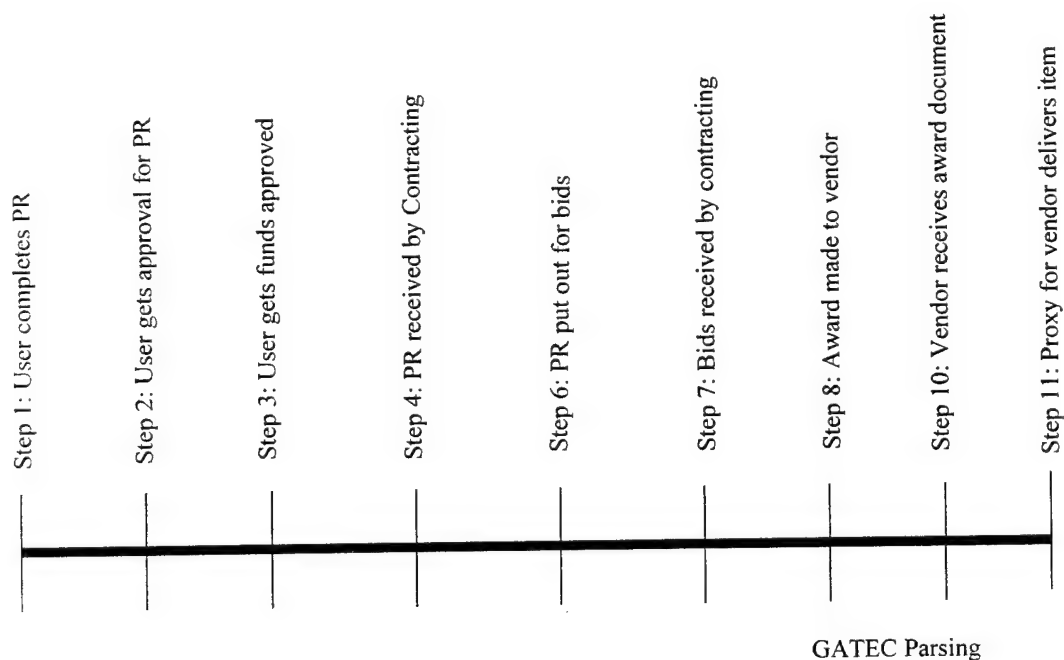


Figure 4-3. GATEC Parsing

Table 4-16. GATEC Parsing

Inception		BCAS Ent		Out pub		Award Date
ave	41.79		2.42		11.26	
sd	63.67		6.40		8.67	
size	53		53		53	

Since GATEC is only operational at Wright-Patterson Air Force Base, the data collection was restricted to the process flow present at that site. During the data collection, it became quickly apparent that locating the folders which contain the procurement package was very difficult. At Wright-Patterson, the buyers use "cradle to grave" administration, and keep the folders at their desks. It almost impossible to find a large number of folders because the responsible buyer is often not updated in the BCAS system. For this reason, only data which is located in the computer was analyzed.

The time between the user completing the PR and entry into the BCAS system is 41.79 days on average. This amount of time is more than double any other MIS system. Since GATEC does not directly impact any processes until the PR reaches the contracting office, this amount of time can only be attributable to processing problems in the using organizations, coordination points and Accounting and Finance.

The time between BCAS entry and when the request for quotation EDI transaction set is transferred out is only 2.42 days. All reviews, requests for additional information, and computer processing takes less than three days.

The time between the RFQ transaction set being processed and award of the purchase order is 11.26 days. Five of these days are attributable to the mandatory advertising time on the computer system. This leaves 6 days of actual processing by contracting after bids are sought.

The times which are not available in the GATEC system were the receipt of the award transaction set by the vendor, when the quotes are received back from the prospective vendors, and all information which would normally be found on the face of an AF Form 9. While the available information was less than expected, this analysis does provide a good indication of the internal processing times inside the contracting office in an EDI office.

MADES II Parsing. Because of the nature of the processing in MADES II offices, different information was available than in GATEC offices.

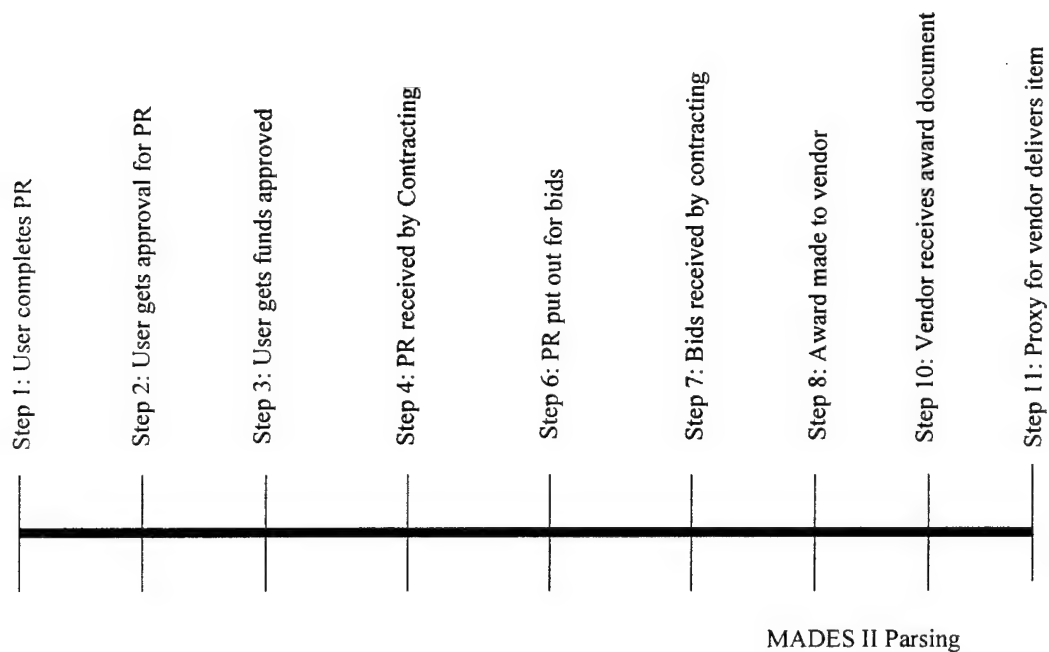


Figure 4-4. MADES II Parsing

Table 4-17. MADES II Parsing

Inception		BCAS Ent		Award Date
ave	14.4		19.33	
sd	7.79		14.11	
size	15		15	

As is indicated by the size field in the Table 4-17, only 15 actions were completed at all of the sites combined. This is attributable to the problems associated with splitting line items on AF Form 9's for award. On the 15 actions, none had the actual AF Form 9's available, therefore only information in the MIS was used.

When the original plan was constructed, almost every step in the MADES II procurement process was going to be studied as is indicated in Figure 4-4. Since the AF Form 9's were not available, the times concerning coordination and Accounting and Finance were not available. The times concerning advertising of the RFQ's was also not available because the processing dates are purged from the MADES II system almost immediately. To retrieve the information, each record must be restored from a tape back-up system. None of the systems administrators at the sites were willing to restore the information because of the inordinate amount of work. The same problem occurred for the transmission of the award transaction set. The non-availability of information only yields limited information about the MADES II system, but does assign responsibility for the different portions of TALT to either Contracting or Pre-Contracting.

BICEP Parsing. The BICEP system provides the greatest amount of information about the elements of TALT inside contracting, of any of the systems that were analyzed.

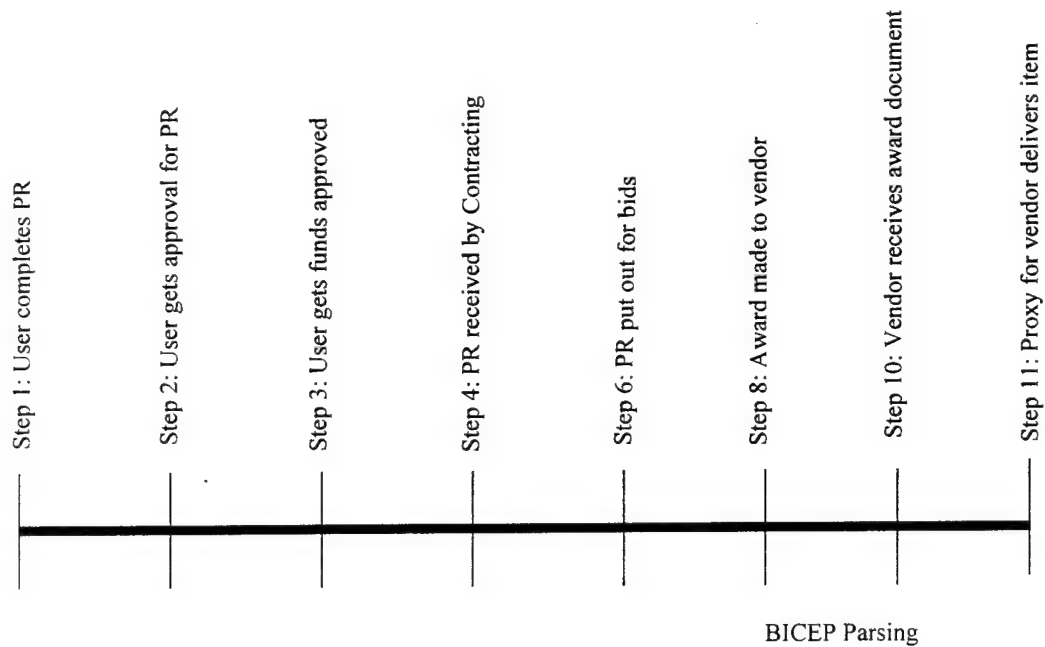


Figure 4-5. BICEP Parsing

Table 4-18. BICEP Parsing

Inception		BCAS Ent		RFQ Out		Award Date		1155 Out
ave	14.68		2.43		14.39		5.96	
sd	29.39		3.09		12.50		4.47	
size	50		49		49		49	

The plan indicated in Figure 4-5 was able to be followed except for the Pre-contracting portion because it is not possible to read the date stamps on the scanned AF Form 9's. During the period when the AF Form 9's are being scanned, the scanners being utilized made it impossible to read the date stamps from Accounting and Finance and Contracting. The problem has since been

corrected, but it made it impossible to collect the required data for this study.

The information collected allows insight into internal processing inside the contracting office.

The pre-contracting time of 14.68 days is attributable the processing of the user, coordination, and Accounting and Finance offices; and not as a direct result of the BICEP system. The 2.43 days is the average time between when the PR was input into the BCAS system and when the written RFQ is generated. This time includes any reviews of the PR packages and any requests for additional information concerning the item descriptions. The 14.39 days between sending the RFQ and award of the purchase order includes the five days to allow vendors to quote on the items. This leaves 9.39 days for actual processing by contracting. The 5.96 days between awarding of the purchase order and faxing a copy includes the time to review the DD 1155 purchase order, obtain a contracting officer's signature, scan the DD 1155, and electronically fax the document.

#### TALT

The final question to be answered is "What is the TALT for each system?".

Table 4-19. TALT-Delivery (MIS Breakout)

		TALT-Del		
	BICEP	BCAS	GATEC	MADES II
Days	26.08163	24.73064	55.4717	33.73333
St Dev	12.53302	24.68548	61.68643	15.54471



This table shows the TALT minus delivery for each MIS. Since information is not directly accessible for delivery times for each system, a proxy must be used. The proxy delivery times for all of the MIS systems is indicated below.

Table 4-20. Mean Delivery Times

ave (days)	32.15
sd	34.96
size	12523

The uncorrected TALT for each MIS is found for the MIS's by adding the delivery time for the proxy to the TALT minus delivery for each system

Table 4-21. Uncorrected TALT

		Uncorrected TALT		
	BICEP	BCAS	GATEC	MADES II
Days	58.3	56.9	87.6	65.9

This time takes into account the time from purchase request inception to the time of award and adds a proxy for the delivery time of the item. What this time does not account for is the differences in systems due to their inherent qualities. The vast majority of the times in the proxy are taken from BCAS systems, and therefore this is taken as the baseline. The inherent qualities affect three of the systems. For BICEP, the time from award to receipt of the purchase order by the contractor is reduced from the BCAS system because the purchase order is scanned and faxed to the contractor instead of relying on the postal system. It was previously determined that this reduction in time is

reduced from 16 days to 1 day (BICEP Brief). This is an overall reduction of 15 days. For the EDI systems, the total time of 16 days is reduced. The corrected TALT is shown below.

Table 4-22. Corrected TALT

		Corrected TALT		
	BICEP	BCAS	GATEC	MADES II
Days	43.3	56.9	71.6	49.9

After the times are corrected, the Bonferroni test can be used to determine if there is a statistically significant difference in the means. The results of this test are as follows:

----- O N E W A Y -----					
Variable TALT					
By Variable MIS_TOT MIS-TOT					
Analysis of Variance					
Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Btn Groups	3	21297.2219	7099.0740	7.4955	.0001
Wth Groups	411	389264.6721	947.1160		
Total	414	410561.8940			
Variable TALT					
By Variable MIS_TOT MIS-TOT					
Mean	MIS_TOT				
43.4300	BICEP				
49.8833	MADESII				
56.8806	BCAS	*			
71.6217	GATEC	**			

Figure 4-6. Bonferonni Test for MIS

The Bonferonni Test shows that there are three distinct groups by the placement of the asterisks. The first group is with BICEP and MADES II with means of 43.43 days and 49.88 days respectively. The grouping shows that there is no statistical difference between the two MIS's. The second group is BCAS with a mean of 56.88 days. The third group is GATEC with a mean of

71.62 days. The F prob column in Figure 4-6 shows that the p-value for the analysis was significant because it was less than alpha, .05 in this case.

The answer to the question is that MIS systems do affect TALT. The regression analysis showed that the BCAS system did not affect TALT and was taken as the base-line. BICEP was also not statistically significant, and therefore equivalent to BCAS in the pre-award phase. MADES II had such a low utilization, that there was not enough variability to show significance for the pre-award phase. GATEC was significant, and increased TALT for the pre-award phase. The times directly after the award of the purchase order changed some of these results because of differences in distribution times. When the total TALT is accounted for, three distinct groups are formed, showing BICEP and MADES II in one group as the systems which reduce TALT the most, BCAS in a separate group in the middle, and GATEC as the slowest in the group.

It is important to note that these results indicate the MIS's in general. For example, the GATEC results show that this system is slowest when compared to the other systems globally, not necessarily GATEC compared to BCAS at Wright Patterson Air Force Base.

Q8. Do accelerated or reduced coordinations affect TALT.

Since the small purchase process is a "pipeline process", or all activities are sequential, it is expected that with any acceleration of a portion of the process, a corresponding reduction in the TALT will occur. To quantitatively

determine the impact of coordinations on TALT, parsing of the procurement process will be utilized to determine its impact on TALT.

The results for this question are intertwined with the results from the MIS in question 7. The parsing of times within the procurement process for each MIS is shown in the results of Question 7. The overall parsing of time is shown in Table 4-23 for all of the data sites.

Table 4-23 Parsing of Time

Period	Coord-TM	A/F-WT	BITS-TM	KT-WT	Pre-RFQ	Post-RFQ	Distro	Delivery
Time	4	2.55	2.37	1.54	2.42	12.84	4.27	32.15
St Dev	6.38	4.53	5.62	3.76	5.06	10.725	5.89	34.96
Number	67	74	123	114	102	103	147	12523

The Coord-TM is the time from purchase request inception to receipt at Accounting and Finance. This time is determined to be 4 days, with 67 purchase requests having enough information to process. AF-WT is the time from when Accounting and Finance receives the purchase request to the time that it was certified. This time is determined to be 2.55 days with 74 purchase requests having enough information to process. BITS-TM is the time from certification of funds to receipt by contracting. This time is determined to be 2.37 days with 123 purchase requests having enough data to process. KT-WT is the time from receipt by contracting to the time of entry into the BCAS system. This time is determined to be 1.54 days with 114 purchase requests having enough data to process. Pre-RFQ is the time from purchase request input into the BCAS system to the time that an RFQ was sent out. This time is only valid for BICEP, GATEC, and EDI. This time is determined to be 2.42 days with 102 purchase

requests having enough data to process. Post RFQ is the time from sending the RFQ to award of the purchase request. This time is only valid for BICEP, MADES II and GATEC. This time is determined to be 12.84 days with 103 purchase requests having enough data to process. Distro is the time from award to fax-out of the DD 1155. This time is only valid for BICEP and BCAS orders processed at Brooks Air Force Base. This time is determined to be 4.27 days with 147 purchase orders having enough data to process. TALT-Del is the number of days from purchase request inception to award in the BCAS system. This time is for all data sites and all MIS's. This time is determined to be 33.1 days with all 508 purchase requests having enough data to process. Delivery is the time from award in the BCAS system to the time of receipt by the proxy. This time is 32.16 days with all 12,523 orders having enough information to process.

To answer this question, coordination points do impact TALT, as can be seen in Table 4-23. As with any pipe-line process, any reduction in any one of these steps will have a corresponding decrease in TALT. Any improvement in process flow or MIS will facilitate this decrease.

## Summary

The factors which are developed in Chapter 2 are the following:

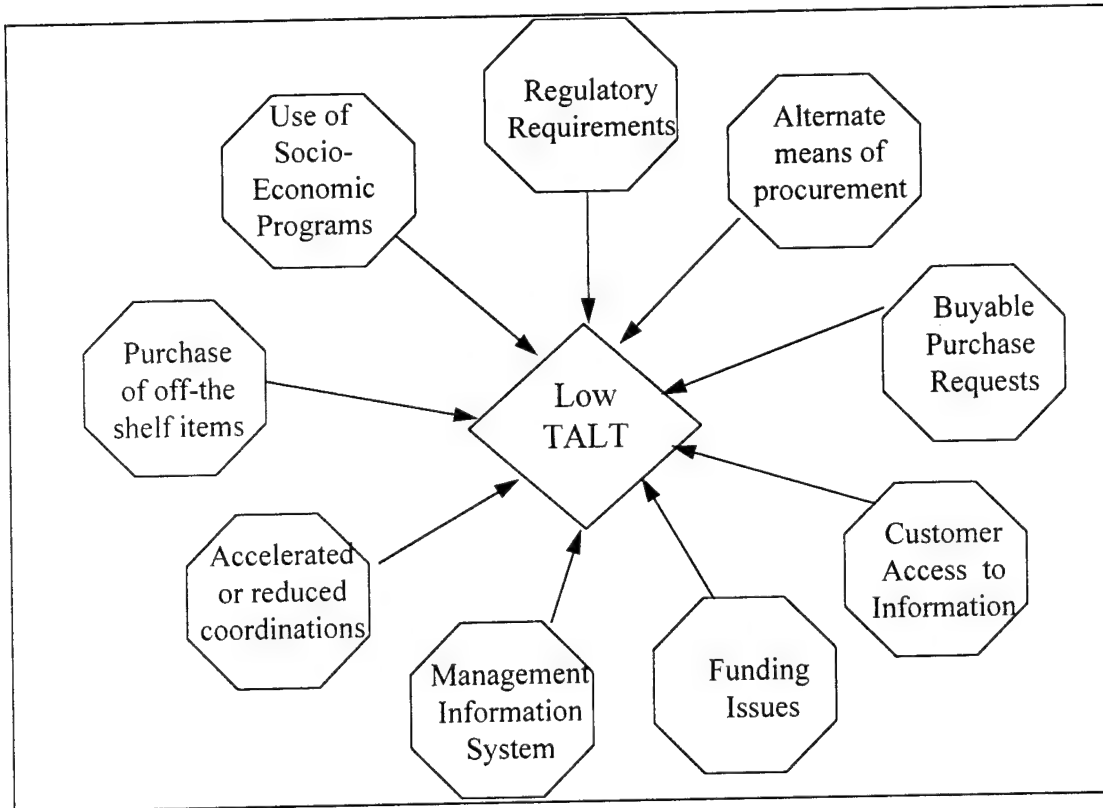


Figure 4-7. TALT Model

The results of the statistical tests show that only some of these factors are actually significant.

Table 4-24. Significant Factors

Regulatory Requirements	Not significant
Alternate Means of Procurement	Not significant
Buyable Purchase Requests	Significant
Customer Access to Info	Not measured
Funding Issues	Significant
Management Information System	Significant
Accelerated or reduced Coords	Significant
Purchase of off the shelf items	Not measured
Use of Socio-Economic Programs	Partially significant

Regulatory requirements, specifically the use of competition, are determined by the regression analysis to not be statistically significant. This means that the use of competition does not impact TALT. The descriptive statistics show that the vast majority of the actions are competitive.

Alternate Means of Procurement are not included in the regression model because of high correlations with GATEC and MADES II. When these MIS's are checked in the regression model, neither are statistically significant, therefore, alternate means of procurement is not statistically significant. It is believed that the reason that EDI is not significant is because of the low usage of MADES II for AF Form 9 actions. When problems with AF Form 9's are resolved, and full implementation of EDI is achieved, it is believed that this factor will become significant.

Buyable purchase requests is significant in the regression model. Descriptive statistics show that the usage of suspenses is relatively low for all MIS's except GATEC. Suspended purchase requests are found to increase TALT.

Customer Access to Information is not measured because it is only offered in one MIS, BICEP. For this reason, there is no variance that can be measured, and therefore all data concerning this is mixed with the MIS factor.

Funding issues is found to be significant by the descriptive statistics. The pipe-line process shows that certification of funds accounts for 4 days of TALT



on average. Any reduction in certification time will have a corresponding reduction in TALT.

Management Information System is found to be significant. While the regression model only shows GATEC as significant, after the full TALT time is added into the equation, there is statistical significance to show that there are three distinct groupings of MIS's; BICEP and MADES II, BCAS, and GATEC. These groupings are taken when compared to each other as a whole, not necessarily as a comparison of one system over another at a specific site. This will be explained in greater detail in the Base Breakout section in this chapter.

Accelerated or reduced coordinations is found to be significant. The parsing of TALT shows the responsibility for each phase in the procurement cycle. Since this is a pipe-line process, any reduction in any portion of the pipe-line, either through accelerated or reduced numbers of coordinations will have a corresponding reduction in TALT.

Purchase of off-the-shelf items is not measured in this study. In an operational contracting environment, the use of non-off the shelf items occurs so infrequently that any variance in TALT is to minimal to be measured.

Use of Socio-Economic Programs is found to be partially significant. In the pre-award phase of contracting, the three types of vendors, large, small, and small with another designator, are found to be statistically insignificant when compared to TALT. After award, the Bonferroni test shows that large businesses and small businesses with another designator are more able to perform on a purchase order than small businesses without a designator.

## Base Breakout

There are many differences in this study which appear to be the result of factors other than the MIS used, and must be attributed to differences at the individual base. To analyze these differences, the information is restructured by base in a Base Breakout. The factors in the regression model are common to all sites in the Air Force, and process flows for purchase requests are relatively standard, therefore the variances in the Base Breakout are due to site specific factors. The variances between the sites are due to factors outside of the model created in Chapters 2 and 3. These variances could be a result of differences in management style, manning levels, funding levels, employee empowerment, civilian/military mix, mission, and customer training. These differences will always be present at each site and this breakout is useful to determine the magnitude of these differences.

The first portion of the base breakout illustrates the time from purchase request inception to date of input into the BCAS systems, or Pre- Contract Administrative Lead Time, for each base used as a data collection site. This measure shows the time which is not the direct responsibility of the contracting office.

Table 4-25. Pre-CALT (Base Breakout)

		Pre-Calt			
	Brooks	Grissom	Scott	Springfield	Wright-Patt
Days	9.87	8.40	9.25	30.33	29.15
St Dev	21.62	14.12	9.65	20.40	40.08
size	100	55	103	57	100

As is shown in the table, there is a wide variance in the mean time to process AF Form 9's by base.

The second portion of the Base Breakout is the Contract Administrative Lead Time (CALT). This time is measured from receipt of a purchase request by contracting to award of the purchase request.

Table 4-26. CALT (Base Breakout)

		CALT			
	Brooks	Grissom	Scott	Springfield	Wright-Patt
Days	13.25	4.80	14.35	1.54	16.09
St Dev	23.16	5.39	15.25	3.49	20.20
size	100	55	103	57	100

Table 4-26 shows there is a great deal of variance in the CALT at each site. This measurement of CALT is different than the typical management report created in BCAS which is reported to higher commands, because this measurement does not allow time for suspensions. This measurement is the absolute time from date of receipt of a purchase request by contracting to the time of award. This absolute time is more meaningful for the purposes of this analysis because this is the actual time that contracting has the purchase request.

The third portion of the Base Breakout is TALT minus the delivery time.

Table 4-27. TALT-Delivery (Base Breakout)

		TALT-Del			
	Brooks	Grissom	Scott	Springfield	Wright-Patt
Days	23.12	13.2	23.60	31.88	48.19
St Dev	14.26	14.11	18.85	21.77	53.31

The TALT-Delivery shows the total time that it takes from purchase request inception to award of a purchase order. This time is determined by adding the Pre-CALT to the CALT. Table 4-27 shows that there is a relatively wide variance by site for this total time, from 13.2 days to 50.7 days. One piece of notable data is that Springfield has a very long Pre-CALT and a very short CALT, which indicates that the office is holding purchase requests after they arrive at the contracting office and loading them just prior to contract award. While the process flow is the same for this base, the recording of the dates is skewed for this particular site. This finding was validated by discussion with the Chief of Contracting at Springfield ANG station, Mr. Leider.

The fourth part of the base breakout shows the usage of various socio-economic programs for each base.

Table 4-28. Socio-Economic Programs (Base Breakout)

		Socio-PGM			
	Brooks	Grissom	Scott	Springfield	Wright-Patt
%W	6.00%	15.79%	14.56%	0.00%	9.00%
%V	1.00%	3.64%	5.83%	0.00%	8.00%
%T	0.00%	0.00%	6.80%	0.00%	3.00%
%S	74.00%	69.09%	64.08%	80.70%	76.00%
%M	1.00%	0.00%	0.00%	14.04%	0.00%
%L	17.00%	10.91%	8.74%	5.26%	4.00%

As was noted in the Regression Analysis portion previously, the use of type L, for large business, indicates that a socio-economic program is not utilized. In the regression analysis, none of the socio-economic programs are shown to have a statistical significance, and, socio-economic codes W, V, T, and M, for woman owned, minority woman owned, disadvantaged, and non-profit, are all lumped together to increase the power of the statistical test.

The fifth part of the Base Breakout is the number of suspensions. Suspensions are found in the regression analysis to increase TALT.

Table 4-29. Suspensions (Base Breakout)

	Brooks	Grissom	Scott	Springfield	Wright-Patt
%	10.00%	0.00%	3.88%	0.00%	15.00%

The percentages in the Table 4-29 indicate the total percentage of purchase requests which do not contain enough information to be purchased when they are received by contracting. A suspension "stops the clock" in the contracting system.

The sixth part of the Base Breakout shows the percentage of competitive purchases for each base. The regression analysis shows that competitive purchases increased TALT.

Table 4-30. Competition (Base Breakout)

		Competition			
	Brooks	Grissom	Scott	Springfield	Wright-Patt
%	89.00%	100.00%	99.03%	92.98%	94.00%

Competition is the only portion of regulation which is measured. While the regression analysis shows that competition increases TALT, there are good aspects related to competition, including lower price and increases in the Defense Industrial Base (DIB).

The eighth part of the Base Breakout is Electronic Data Interchange (EDI) usage. EDI usage is the only portion of alternate means of procurement which can be measured centrally.

Table 4-31. EDI Usage (Base Breakout)

		EDI			
	Brooks	Grissom	Scott	Springfield	Wright-Patt
%	10.00%	0.00%	8.74%	0.00%	53.00%

EDI usage is not found to be statistically significant. It is believed that the reason for this is the low rate of utilization for EDI in AF Form 9's due to Accounting and Finance problems in splitting line items on AF Form 9's for MADES II awards.

The ninth part of the Base Breakout is an analysis of the types of MIS systems at each base.

Table 4-32. Types of MIS (Base Breakout)

	MIS				
	Brooks	Grissom	Scott	Springfield	Wright-Patt
#BCAS	44	57	94	57	47
#BICEP	50	0	0	0	0
#GATEC	0	0	0	0	1
#MADES	6	0	9	0	0
Total	100	57	103	57	100
%BCAS	44.00%	100%	91.26%	100%	47.00%
%BICEP	50.00%	0	0.00%	0	0
%GATEC	0	0	0.00%	0	53.00%
%MADES	6.00%	0	8.74%	0	0.00%

Table 4-32 shows the total number of data points collected for each base, number of data points for each type of system at each base, and percentage of usage for the sample.

The conclusion drawn from the Base Breakout is that there are substantial differences solely to the internal differences at each base. These differences include differences in manning levels, workloads, employee empowerment, employee job satisfaction, management style, and small differences in process flows. The best way to determine the specific causes at each site is to conduct case study research at different bases to determine differences.

Table 4-33. Question and Answers

Question	Answer
Q1: Socio-Economic Program	Pre-Award: No effect Post Award: Small Businesses not as fast as Large and Others
Q2: Regulatory	Competition does not affect Total Acquisition Lead Time
Q3: Alternate Means of Procurement	EDI does not affect TALT in this model. Low usage believed to be responsible
Q4: Inadequate purchase requests	Suspensions do affect TALT
Q5: Automated Access to Information	Not able to be studied
Q6: Funding Issues	Certification of Funds do affect TALT. Any reduction in A&F cycle time would have corresponding reduction in TALT
Q7: MIS	BICEP and MADES II in group as fastest, BICEP in middle, GATEC slowest
Q8: Accelerated or Reduced Coordinations	Do affect TALT. Pipe-line cycle, any reduction would have corresponding reduction in TALT

### Conclusion

Chapter 3 provides the outline for the how the research is to be conducted and describes the main statistical tests to be employed, the regression analysis to determine significance of the factors, Bonferonni technique to determine the differences in the means for the socio-economic programs and the MIS systems, and the use of descriptive statistics to show the usages of each factor at the respective data collection sites and the parsing of time for each phase of the procurement cycle.



Chapter 4 reports the results of the research and shows that the factors in the model developed in Chapter 2 do affect TALT. Competition was found to not affect TALT, Alternate means of procurement was found to be so correlated with the EDI systems that the results were mixed with the MIS factor. Suspended purchase requests were found to increase TALT. Customer access to information was too correlated to BICEP to measure individually. The certification of funds was found to increase TALT by approximately 5 days.

Management information systems were found to affect TALT, with 3 groupings, BICEP and MADES II, BCAS, and GATEC. While only GATEC was found to be statistically significant when looking at the pre-award phase, the grouping of MIS's for total TALT was found to be statistically significant. Accelerated or reduced coordinations were found to be statistically significant, with any reduction in the time for coordinations, or the reduction of any coordination points, having a corresponding reduction in TALT. Purchase of off-the shelf items was not able to be tested. Finally Use of Socio-economic programs was found to be significant only in the post-award phase of the procurement cycle. During this time, large businesses and small businesses with another socio-economic designator were seen to out-perform small businesses without a designator.

The regression model was able to account for approximately 16% of the variation in TALT. The other 84% was attributed to factors outside of the model, mainly at the local level. These factors were analyzed in the base breakout which shows utilization for each factor by base.

Chapter 5 reports the conclusions which can be drawn from the results in Chapter 4, along with the limitations of these results, and gives indications of future research which could be conducted to validate these results.

## 5: Conclusions

### Background

In Chapter 1, an overview of the problem was created. This chapter explains the need for the research in general. Chapter 2 is the literature review which presents a review of the applicable literature in the area of efficient procurement, Total Acquisition Lead Time (TALT), and local Management Information Systems (MIS). Chapter 2 also develops the model from which the rest of the thesis is based. Chapter 3 explains the research method. Chapter 4 reports the results of the research. This chapter explains conclusions which are drawn from the research, proposes areas of future research, and explains the limitations of this research. To understand the conclusions to be drawn from this thesis, the model must be reviewed.

### The Model

The model which was created for efficient procurement shows that there are many factors which have effects.

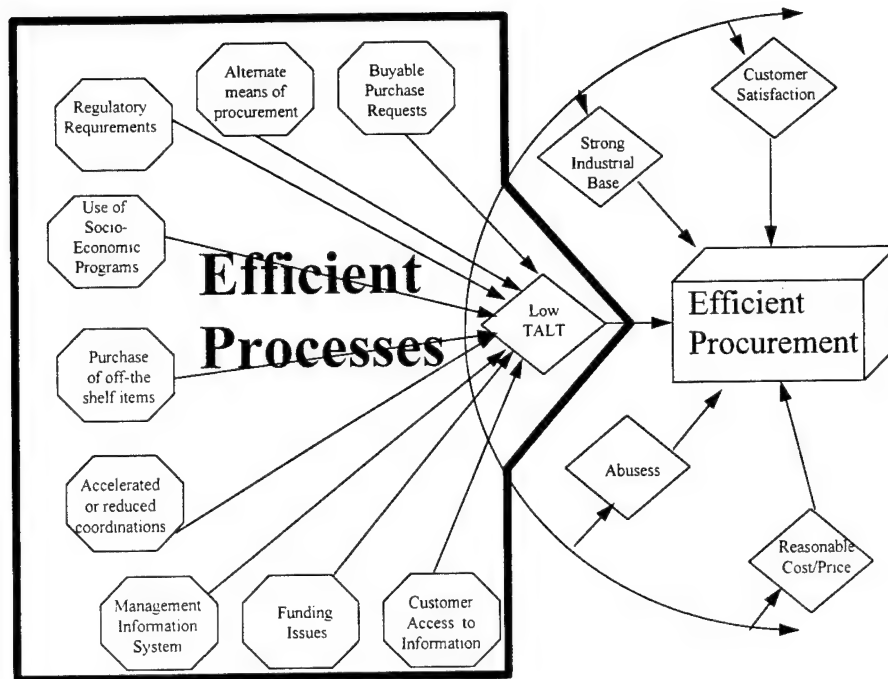


Figure 5-1. Efficient Procurement Model

The only part which is analyzed for this thesis is Total Acquisition Lead Time (TALT). TALT has 9 factors which affect it, Buyable Purchase Requests, Alternate Means of Procurement, Regulatory Requirements, Use of Socio-Economic Programs, Purchase of Off-The-Shelf Items, Accelerated or Reduced Coordinations, Management Information System, Funding Issues, Customer Access to Information. Each of these factors is studied in detail using a variety of statistical techniques. Figure 5-1 shows the significance of each of the factors.

Table 5-1. Significant Factors

Regulatory Requirements	Not significant
Alternate Means of Procurement	Not significant
Buyable Purchase Requests	Significant
Customer Access to Info	Not measured
Funding Issues	Significant
Management Information System	Significant
Accelerated or reduced Coords	Significant
Purchase of off the shelf items	Not measured
Use of Socio-Economic Programs	Partially significant

Buyable Purchase Requests. Buyable purchase requests was found to be significant. The regression analysis in Chapter 4 shows that when purchase requests are received in Contracting without all of the required information, there is a corresponding delay in TALT. Small purchase contracting is a pipeline process and when there is a delay in the process, such as receiving an incomplete purchase request package, there is a corresponding delay in the TALT. The only cure for this type of problem is customer training to reduce the number of incomplete packages. The results indicate that some bases used suspenses more frequently than others, indicating differences in management policies. It is important to remember that if the purchase request is suspended in BCAS or not, there is always a delay if purchase requests are received without enough information to purchase.

Any system which can track reasons for suspended purchase requests can help to target training either for customers or vendors, or may lead to improvements in the MIS's to compensate for consistent problems. One glaring example a consistent problem which causes suspenses is contracting receiving an insufficient item description (Wann interview, 1996). If the MIS's were altered

to mandate the proper input of information by the user, much of the scrap and rework in Operational Contracting would be reduced. Another example of a consistent problem is vendors proposing "equals" to EDI request for quotations (Wann Interview, 1996). The current implementation does not allow vendors to send information about equals so that contracting can make an informed decision about purchases.

Once problems are tracked, education of contracting personnel, users, vendors, and programmers for the MIS's can occur and real changes be made to make the entire process more efficient. Currently, the only means of tracking problems is anecdotal at best.

The prescription for this factor is to provide better customer training to avoid delays caused by inaccurate or missing information on purchase requests. The tracking needed to target the training must be an automated technique to avoid additional delays due to the tracking system itself. The suspension module in the BICEP program could be used as a model in future MIS's to facilitate the targeted training of individuals, organizations, or common problems.

Alternate Means of Procurement. Alternate Means of Procurement was not found to be significant. This thesis discussed many different types of alternate means of procurement, but only analyzed one. Most alternate means of procurement are decentralized, and therefore difficult to analyze. Electronic Commerce (EC) is the only centralized alternate means of procurement, and therefore the only part which is studied. This factor is not statistically significant

for AF Form 9 actions in the qualitative regression analysis. This is because of the relatively low usage of EC in Form 9 actions (Oakes interview, 20 March, 1996). Accounting and Finance does not allow for the splitting of line items on AF Form 9's which makes it very difficult to advertise using EC, because each line item is advertised separately, and should often be awarded to different vendors. Until this difficulty is corrected, it is not likely that usage will increase for AF Form 9 actions. Automated actions do not suffer from this same problem.

It was noted by Brooks Air Force Base, that EDI or faxing of quotations, as is accomplished by BICEP, can act as the workhorse for the organization (Wann Interview, 1996). As was seen by the results of TALT in Chapter 4, the BCAS sites were very close to the other sites on their processing times. The problem with this analysis is that large organizations, such as Wright Patterson, would be completely swamped with purchase requests if they had to rely on the manual BCAS system. EDI and automated faxing of quotations can relieve the manpower intensive administrative tasks, and allow for a more efficient overall procurement process. Manual telephonic calls have always been the fastest means of quotations when considered for individual purchase requests, but are often not able to handle large workloads without very large numbers of people. Automated means of procurement, have slowed individual orders, but allowed less people to process more awards more quickly. As EDI usage increases, it is expected that overall efficiency of the procurement process will increase.

The prescription for this factor is two part. The problems with Accounting and Finance regarding multiple line items on AF Form 9's must be resolved

before EDI will be an effective tool for AF Form 9 actions. The second part of the prescription is to continue with the implementation of EDI so that it can become a significant factor. It is recommended that this factor be retested after Accounting and Finance fixes problems relating to AF Form 9's, and full implementation of EDI occurs.

Regulatory Requirements. Regulatory requirements were not found to be significant. Regulatory requirements are present in every aspect of Federal Procurement. Because it is difficult to parse the regulatory requirements from process flows, it is almost impossible to determine the entire effect of regulatory requirements on Federal Procurement. For the purposes of this research, only the most prevalent portion of regulation, competition, is selected for research. The qualitative regression analysis shows that the use of competition does not affect TALT. This finding is important because fears of slowing the process for competition can be alleviated, and the good aspects of competition can be enjoyed. These good aspects include reductions in price, increases in the defense industrial base, and increases in the use of socio-economic programs. Descriptive statistics show that the vast majority of actions are already competitive. The EDI sites showed 100% competition.

The prescription for his factors is an increase in customer training. Customers need to be trained that the use of competition in small purchases will not adversely affect the procurement cycle, so that item descriptions will be more



likely to be written more broadly. This will allow for a wider range of vendors to be able to participate in Government procurement.

Use of Socio-Economic Programs. The use of socio-economic programs was found to be partially significant. Differences in pre-award time was found to be insignificant, and differences in post-award times were found to be significant. The Federal Government, specifically Congress, has mandated that the Defense Department use its procurement system to further its socio-economic goals, giving business to small and disadvantaged businesses. This research was able to show that for the pre-award phase of procurement, the use of socio-economic programs has not adversely impacted lead times. For the post-award phase, the use of socio-economic programs has not impacted performance for small businesses with other designators such as woman-owned or disadvantaged when compared against large businesses. Small businesses without a designator are shown to fall behind large businesses. The reason for the difference between small businesses and small businesses with another designator is not known.

The implications of this finding is that socio-economic programs can be pursued without the fear of slowing down the procurement cycle, at least the pre-award portion. Many disadvantaged businesses have been placed under fire for not being able to perform, or labeled as slower than large businesses. The results from this study indicate that the disadvantaged businesses were the most likely to perform on time for small purchase actions.

The prescription for this factor is customer training. Users need to be educated about disadvantaged businesses to alleviate concerns about their performance history. Small disadvantaged businesses were found to be just as able to perform as large businesses. Users also need to be trained that the use of socio-economic programs does not affect the time to award a purchase order.

Accelerated or Reduced Coordinations. This factor was significant, and reduces TALT. The research is able to parse the time throughout the procurement cycle and show that any reduction in the coordination cycle has a corresponding reduction in TALT. This is an important finding because initiatives are currently under way to automate coordinations, such as the Financial Electronic Documents Server (FEDS). Any reduction in the coordination time has a corresponding reduction in TALT.

The findings from this study indicate that approximately 20% of TALT occurs before contracting receives the package. Any automation technique or policy change which would reduce that pre-contracting time would have a corresponding reduction in the total time for the procurement.

The prescription for this factor is for policy makers to look closely at the regulations which require coordination points and to determine if any coordinations can be reduced or eliminated. The second part of the prescription is to develop future MIS's to incorporate features which will help automate and speed coordinations.

Management Information System. This factor was found to be significant. This is the area which has the greatest amount of research in the thesis. The qualitative regression analysis shows that BCAS and BICEP have no effect on pre-award activities, and serve as a base-line. All other MIS's studied increase TALT, when considering the time from purchase request inception to the time of award. GATEC, MADES II, and BICEP all have features which decrease TALT directly after award. When all factors are considered, BICEP and MADES II are able to outperform BCAS alone, according to this data.

There are two basic problems with this finding. The first problem is there is no frame of reference. These findings are compared to the other sites and do not reflect improvements that a particular site has seen. For example, at Wright Patterson, GATEC appears to actually slow the procurement cycle. The problem is that all of the data to compare it against its past performance has already been purged from the system. It is very possible, and likely, that GATEC has improved their performance, and that their past performance, due to low manning levels or other factors, was at a level that was lower than seen with GATEC. The only finding that this thesis can make is that when compared to other sites, the GATEC system is slower than the other sites using different MIS's.

The other problem with the MIS study is that it is very possible that the local initiatives appear to be slow, but actually free buyers to make BCAS awards faster. According to the Supply Branch Chief at Brooks Air Force Base, BICEP has allowed them to take some of the workload off of the buyers, so that BCAS

awards can be made faster. She stated that manual calling for quotations is always faster than relying on BICEP or EDI for individual orders, but that when there is a backlog of BCAS purchase requests, BICEP or EDI help them (Wann Telephone Interview). To illustrate the point, a single purchase request can be purchased in a contracting office within minutes if the telephone is used to get quotes, but when there are 100 other purchase requests behind that purchase request, all 100 purchase requests must wait. Automated techniques such as BICEP or EDI allow some of the purchase requests to be handled by fewer people, and with higher volume, and allow other buyers to purchase using BCAS at a faster rate. BICEP and EDI will never be able to beat BCAS awards for individual orders because both must wait for responses to the request for quotations to return to the office which usually takes a few days while BCAS orders can be placed in minutes. MIS's like BICEP and EDI can reduce backlogs and make the overall TALT lower on the whole as was seen in this research. Systems like BICEP and EDI can be likened to workhorses which reduce backlogs and speed the entire process, even if they are not the fastest link in the process flow.

The prescription for this factor is to create future MIS's which incorporate features which reduce TALT, using lessons learned from MADES II, BICEP, and GATEC. With the advent of more powerful computers and reductions in manning levels, MIS's will have to be used to alleviate shortages.

Funding Issues. This factor was found to be significant. There are many funding issues which affect TALT. These are described in Chapter 2, and include the "end of fiscal year rush", yearly appropriation of funds, and certification of funds. The only part of funding which has quantitative data available is the certification of funds. This research is able to show that the certification of funds does have an impact on TALT.

The prescription for this factor is for policy makers to analyze the current process flow for certification of funds. The only way to lessen the impact of certification on TALT is to decrease the amount of time for certification of funds. This could be in the form of automation, such as the FEDS project, or through the block commitment of funds, such as what is accomplished with the IMPAC card with an AF Form 616. Any decrease in the time that commitment of funds takes, has a corresponding decrease in the TALT.

Customer Access to Information. This factor is not able to be studied because only one system grants access to information to the resource manager, and therefore all effects are mixed with the BICEP MIS factor. Since it is not possible to show any qualitative data, it is impossible to draw any hard conclusions, but if the end users are able to determine status without disturbing buyers, buyers should be able to be more productive. As is discussed in Chapter 2, when resource managers were granted access to the Contracting MIS at Brooks AFB, telephone calls were greatly reduced, and buyers were more able to work on Contracting.

The prescription for this factor is to study the impact of customer access to information on TALT. There are currently MIS's in place which allow users to see status, and preliminary results of studies at Brooks Air Force Base. A cost/benefit analysis would show if granting of this status is a viable option for future MIS's.

Table 5-2. Problems and Prescriptions

Problem	Prescription
Q1: Buyable purchase requests	Provide better customer education, create future MIS to track suspensions.
Q2: Alternate Means of Procurement	Not significant. Retest after full implementation.
Q3: Regulatory Requirements	Competition is not significant, tell customers.
Q4: Use of Socio-Economic Programs	Provide customer education.
Q5: Accelerated Coordinations	Look closely at regulations and coordination points. Automate coordinations.
Q6: Management Information System	Create future MIS to include features which reduce TALT. Use lessons learned from GATEC and BICEP.
Q7: Funding Issues	Analyze current process flow. Possibly automate certification process.
Q8: Customer Access to Information	Need to study impact.

### Implications for Future Research

This research opens the door to a great deal of opportunities for future research. The approach for this study was very broad, crossed many different data sites, and attempted to study many different factors.

The first area of future research is with regard to regulation. The regulation factor should be studied in greater detail to determine the impact of all regulations on TALT. Recent acquisition reform actions have attempted to emulate commercial practices. A case study which compares federal procurement to commercial procurement is best suited to determine the effects that all federal procurement regulations and laws have on TALT as well as price.

The second area of research regards process flows. In this research, a general process flow for all small purchases is identified. There are differences due to local base policy as well as other factors which accounted for 86% of the variability in TALT, according to the regression model in Chapter 4. An in-depth case study of the differences in process flows may yield improvements which could be universally adopted to reduce TALT and increase productivity.

The third area of future research deals with funding. Because the only data available on funding issues concerned the certification of funds, this is the only aspect which was studied. More research on other aspects of funding issues, including the impact of the end of year and periodic funding could produce findings to help Contracting offices deal with these issues. This could be accomplished through a case study.

### Limitations of the Study

There are limitations in this study. While a wide cross section of the Air Force population was used to allow the widest conclusions, it was difficult to retrieve data for all of the variables. The regression analysis utilizes a qualitative approach which only shows significance and direction of significance. The magnitude of the significance was not able to be determined using this technique. Some of the factors did return results of not significant, and the effect was to dilute the overall power of the regression analysis. This study is valid for Air Force installations which procure operational support items in the Continental United States, under non-wartime or non-contingency operation. Contingency and overseas operations operate in a different environment, and results from this study should not be used in these arenas.

### Conclusion

This research is able to show that four of the factors in the original model affect TALT. These factors are Buyable Purchase Requests, Accelerated or Reduced Coordinations, Management Information System, and Funding Issues. The greatest amount of the research is on the impact of Management Information Systems, because this is the area where the greatest amount of change has occurred and is likely to continue. Future MIS's may be able to incorporate portions of this research to decrease overall TALT.



Before this thesis, the impact of many of these factors was unknown. Since federal procurement is so different from commercial procurement, it was believed that the use of competition would severely slow the process of procuring items. Electronic Commerce (EC) in federal procurement is still in its infancy, and the impact of the use of EC is still greatly unknown, but the expectation is that it will provide for large savings both in terms of money and manpower. Funding issues have always been a "necessary evil" because, while they slowed the process flow for procuring items, they provided for the necessary checks and balances to ensure the availability of funds. Management Information Systems have been used recently to attempt to counter reductions in manpower. Findings from studies such as this can be used in future studies to leverage the use of technology to the fullest extent. The use of socio-economic programs have been a consistent factor that contracting must contend with since Congress started using federal procurement to attain its social goals.

This study attempted to look at each of these factors to determine if they affected total acquisition lead time, or the time from purchase request inception to delivery of the end item. It was successful in showing that suspended purchase requests, certification of funds, the management information system, accelerated coordinations, and socio-economic programs were significant in their effect on TALT. This study also showed that competition, the use of EDI, and the pre-award time for socio-economic programs were not significant, or did not affect TALT.

The results of this thesis should be used in two basic ways. First, contracting professionals and users need to be trained about the results so that behaviors and misperceptions can be changed. Many times users become very frustrated with the procurement system, because they do not understand it. The results of this thesis could help users to understand how these factors interact with their procurement processing time. The second way that the results of this thesis should be used is by policy makers. These results should be used when making policy decisions which relate to these factors to understand how changes in policy will affect procurement processing time. Furthermore, policy makers should use this information when designing new MIS's and process flows to understand impacts on TALT.

Since virtually every organization on any Air Force Base is dependent on Operational Contracting to procure its requirements, it is important to attempt to expose those areas which could be improved to speed processing times. This thesis has been able to successfully expose some of these areas, and to show that other areas which were previously thought to increase processing times, actually have no effect.

## *Appendix A - Glossary of Terms:*

BCAS - Base Contracting Automated System - Management Information System used for Operational Contracting Squadrons or Divisions.

BICEP - BCAS Image Capability System - Imaging system utilized at Brooks AFB and Patrick AFB. BICEP has substantially reduced their respective CALTs.

BITS - Base Information Transpiration System - Internal transportation system for documents from office to office on an Air Force Base.

BPA-Blanket Purchase Agreement - A non-binding contractual instrument which can be decentralized, allowing users to order directly from vendors.

CALT - Contract Action Lead Time - The time from receipt of a purchase request by contracting to the time of award. CALT is an internal measurement tool used by contracting and is relatively meaningless to the end user because it is only one piece of the total time.

CICA-Competition in Contracting Act of 1984- Regulation enacted by Congress from which started the Federal Acquisition Regulation.

DLA - Defense Logistics Agency - Department of Defense Agency responsible for defense logistics. Many of the Base Supply items are procured by DLA and stored in DLA depots.

EC/EDI - Electronic Commerce/Electronic Data Interchange - The electronic transfer of transaction sets which allow contracting actions via a computer to the general public.

End Item - A deliverable item, a service, a construction project, or a repair under the small purchase threshold as defined by the FAR.

FASA - Federal Acquisition Streamlining Act of 1994 - Act which was enacted out of Vice President Gore Blue Ribbon Commission designed to streamline the acquisition process.

FAR - Federal Acquisition Regulation - A codified regulation governing procurement for all executive agencies.

FEDS - Financial Electronic Documents Server - A management information system which allows users to fill in financial documents on-line and receive coordinations via e-mail distributions.

GATEC - Government Acquisition Through Electronic Commerce - The Air Force's first attempt at EC/EDI and open system solution for an operational contracting squadron. This system was still tied to a proprietary system for its information.

GOCESS/COCESS - Government Operated Civil Engineering Store/Contractor Operated Civil Engineering Store - Civil Engineering's requirements generation, receiving, and storage office for items required.

GSA - General Services Administration - Executive Agency responsible for all computer purchases and GSA schedules.

IMPAC -International Merchant's Purchase Authorization Card - A Government Visa card which allows decentralized purchasing by users.

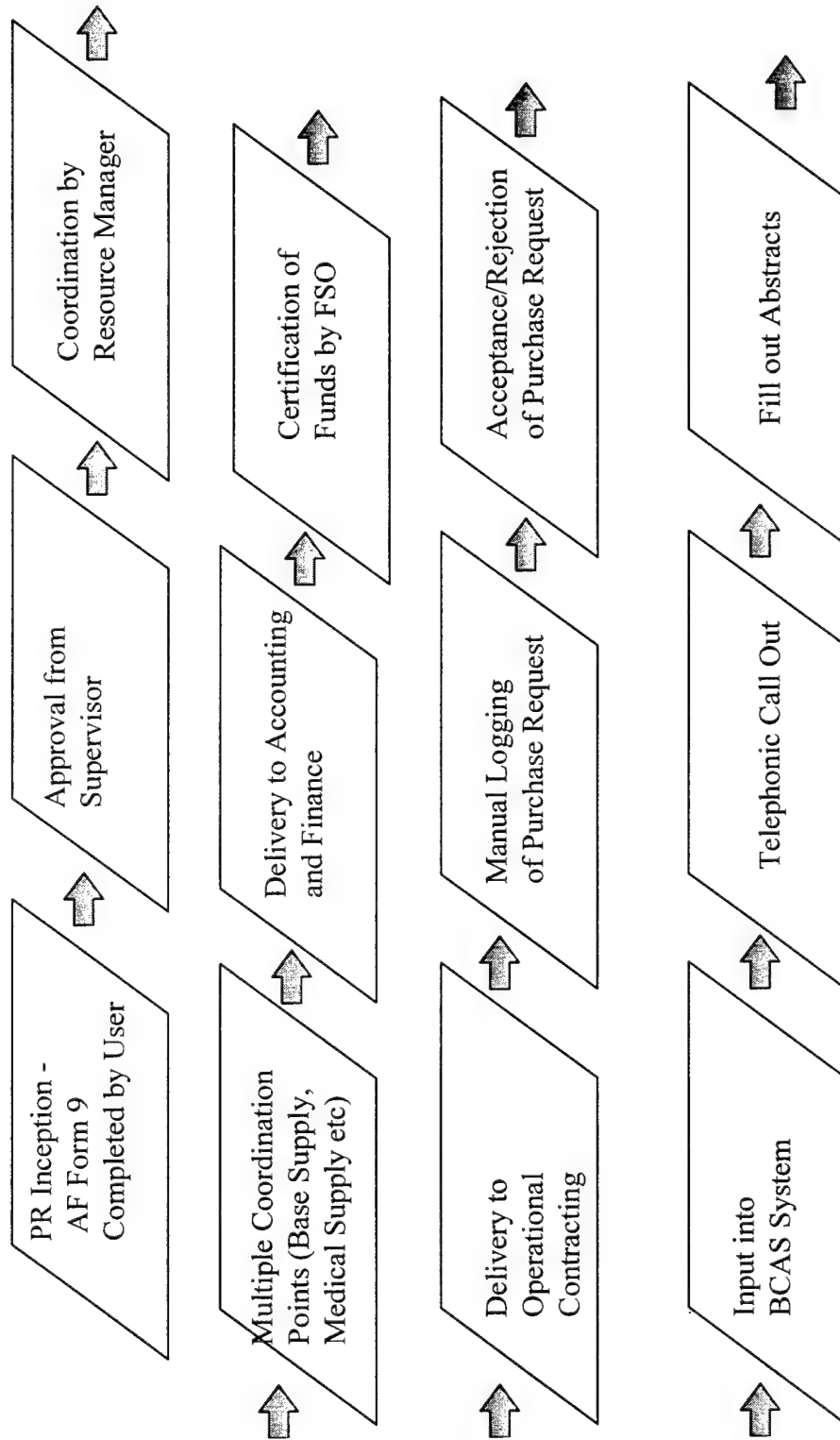
MADES II - Menu Aided Data Entry System II - Formerly a contract writing system which was enhanced to become the current EC/EDI platform. MADES II currently operates on a proprietary system.

PR - Purchase Request - A funded document providing all information needed for contracting to purchase a requirement.

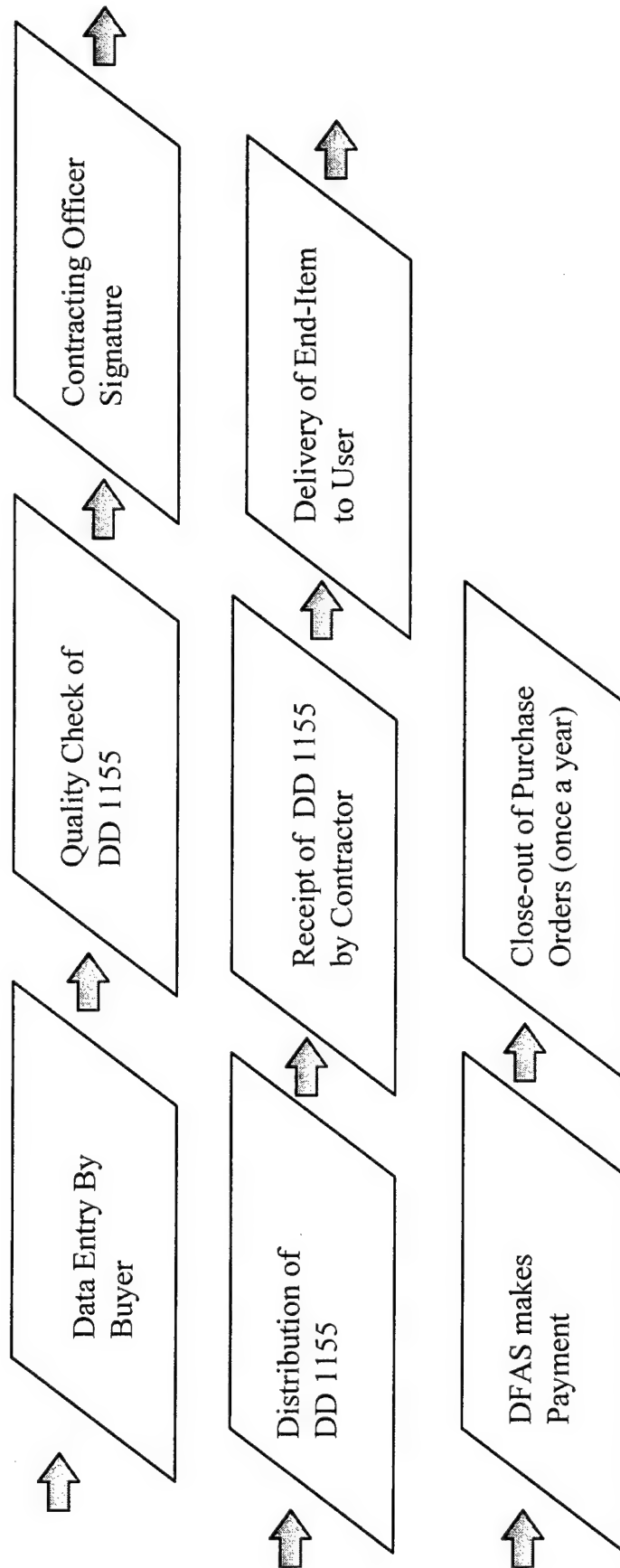
RFQ - Request For Quotation - A request, either written or oral, from the contracting office, for vendors to provide a bid for an item.

TALT - Total Acquisition Lead Time (also referred to as ALT) - The time from purchase request inception to delivery of the item.

# Process Flow for AF Form 9's - Typical Office

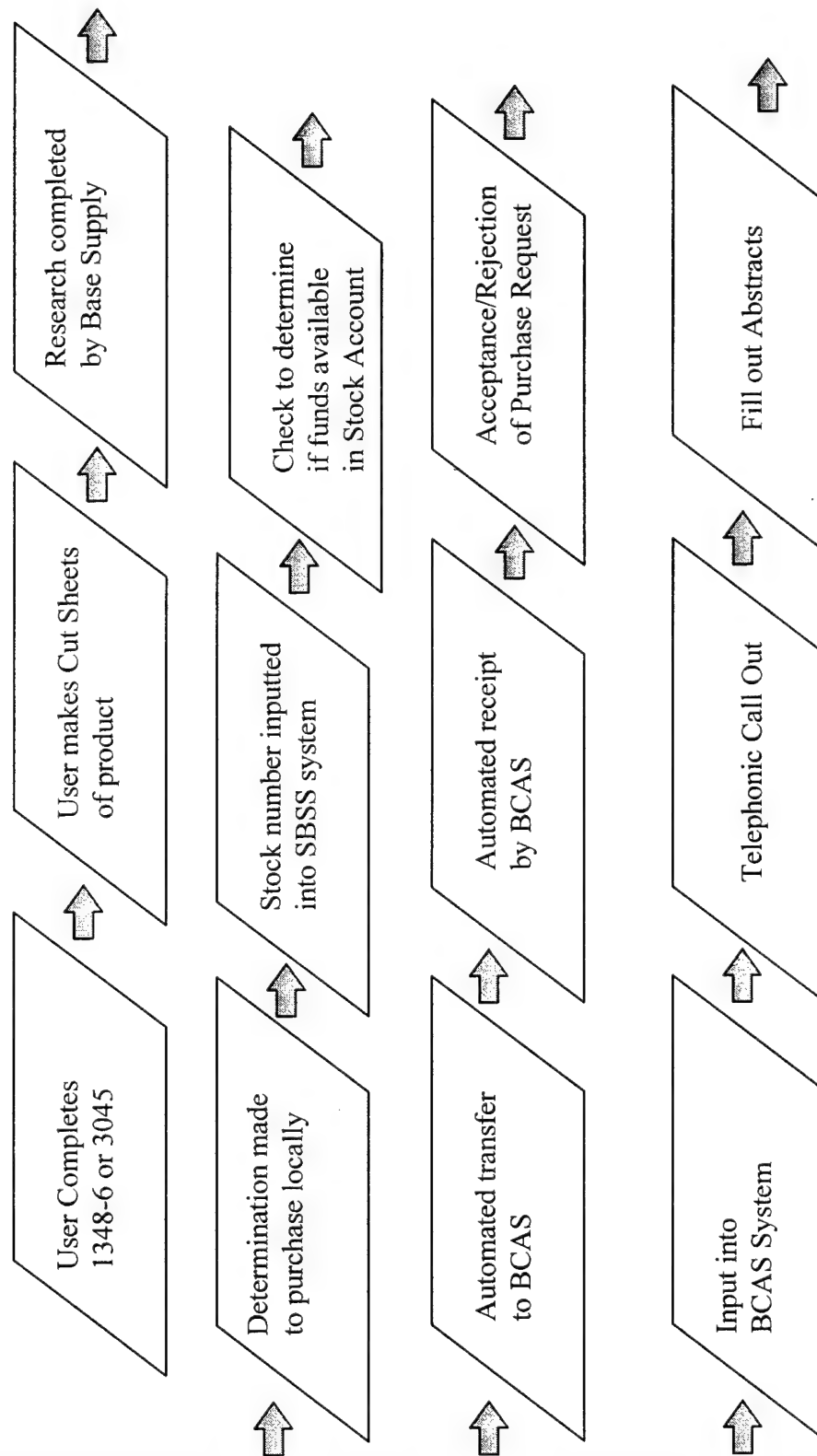


# Process Flow for AF Form 9's - Typical Office (Continued)

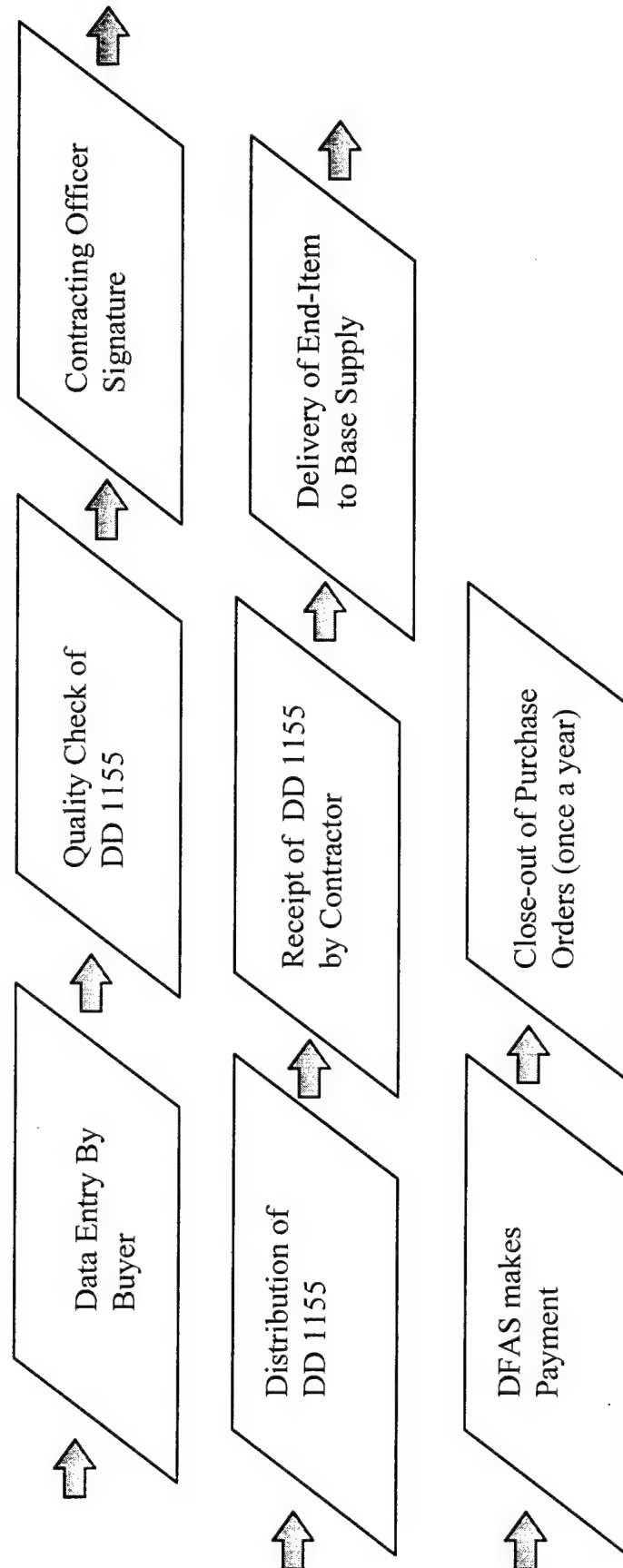




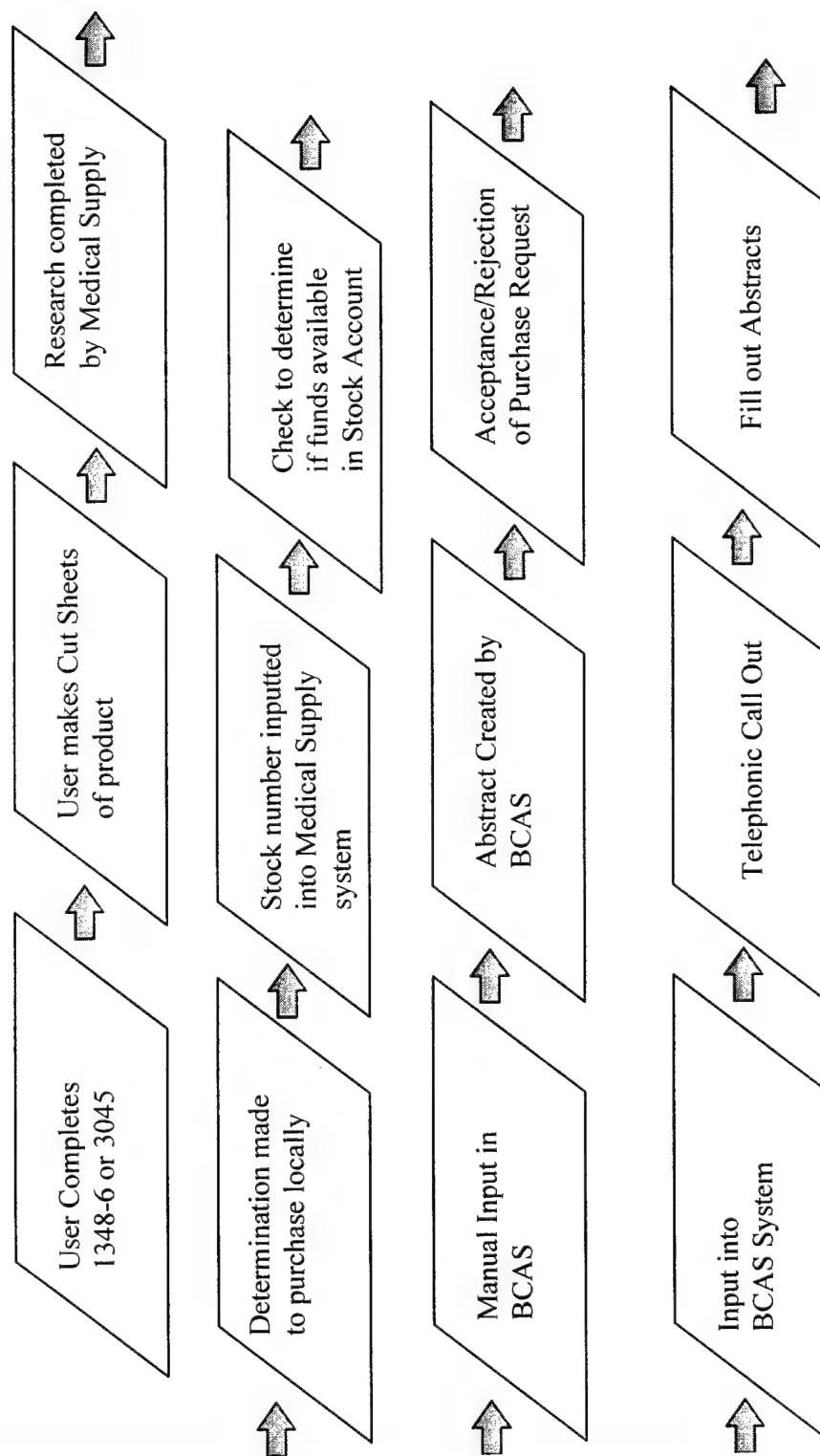
# Process Flow for Base Supply Customers Using Local Purchase- Typical Office



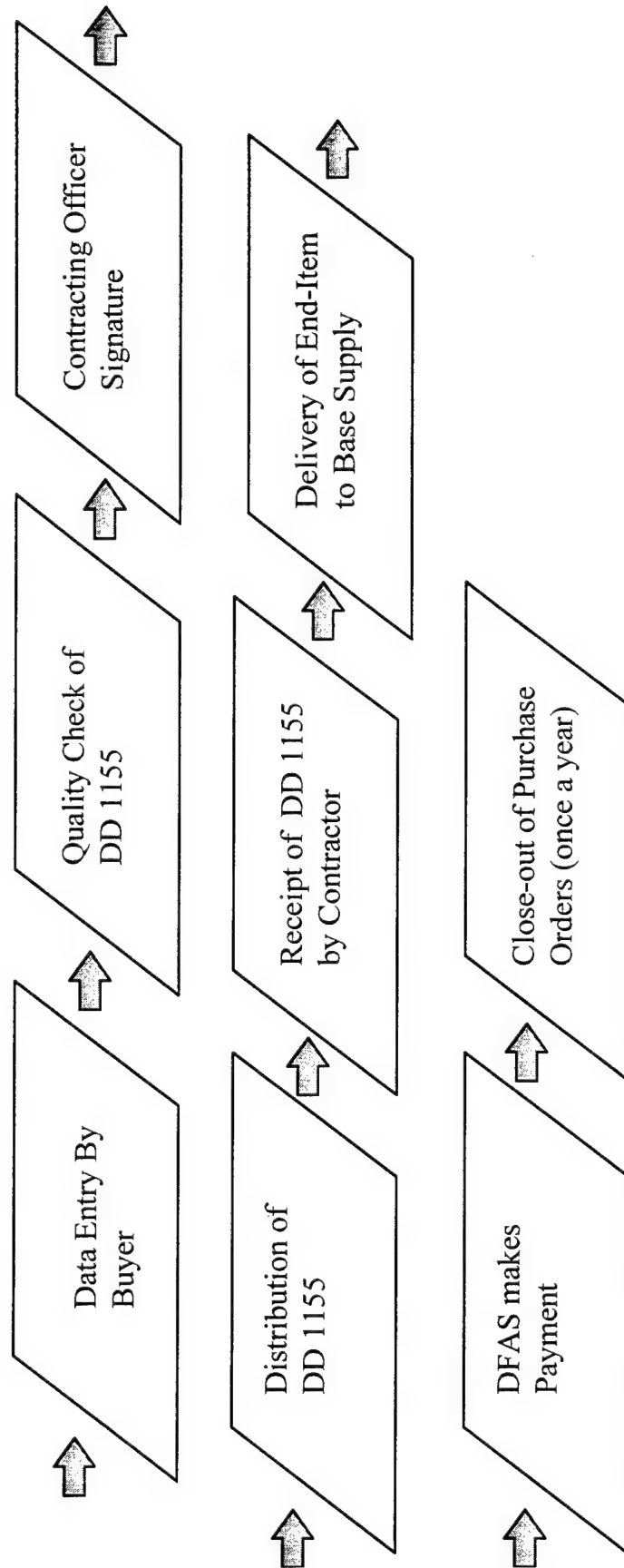
# Process Flow for Base Supply Customers - Typical Office (Continued)



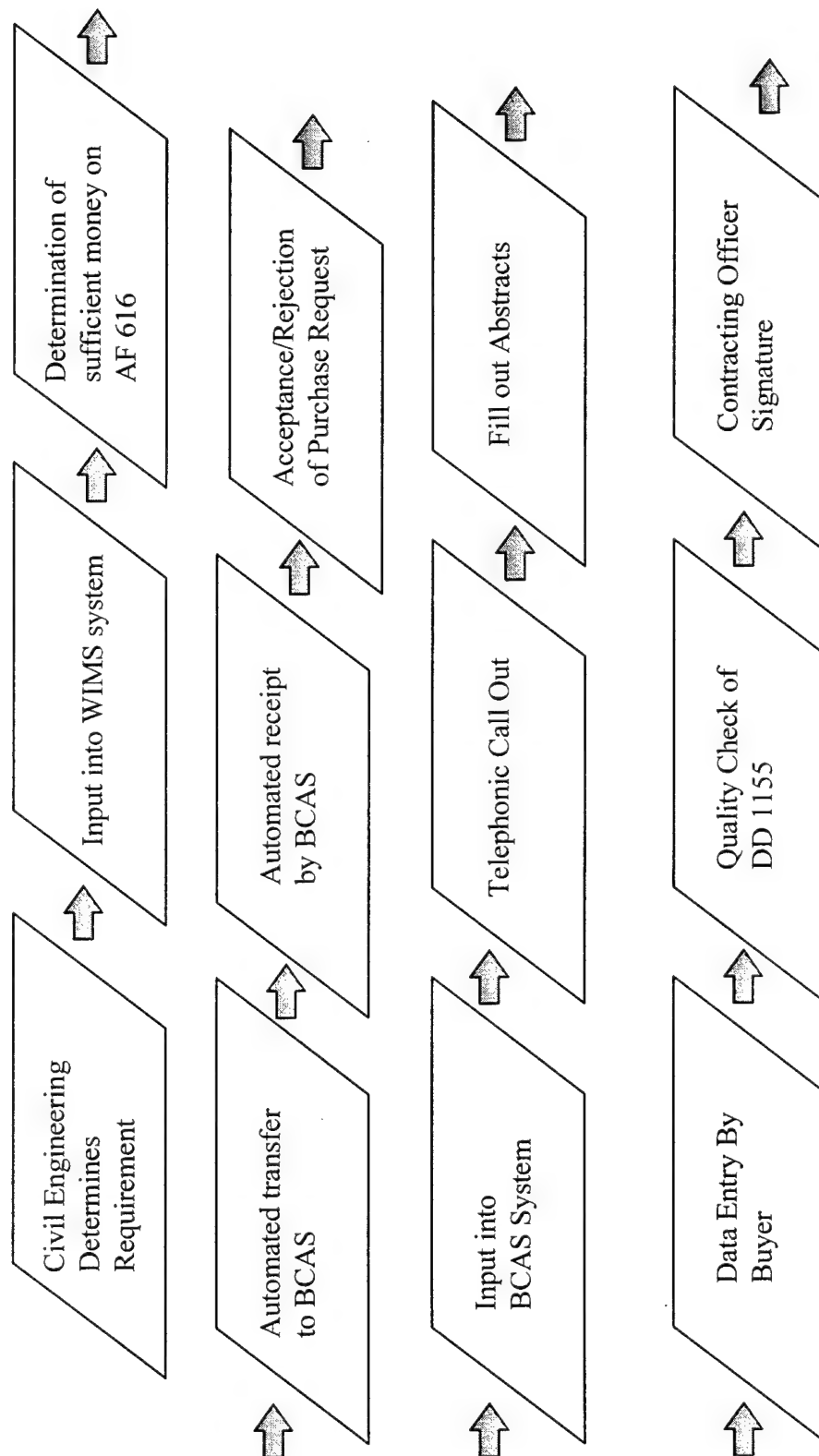
# Process Flow for Medical Supply Customers Using Local Purchase- Typical Office



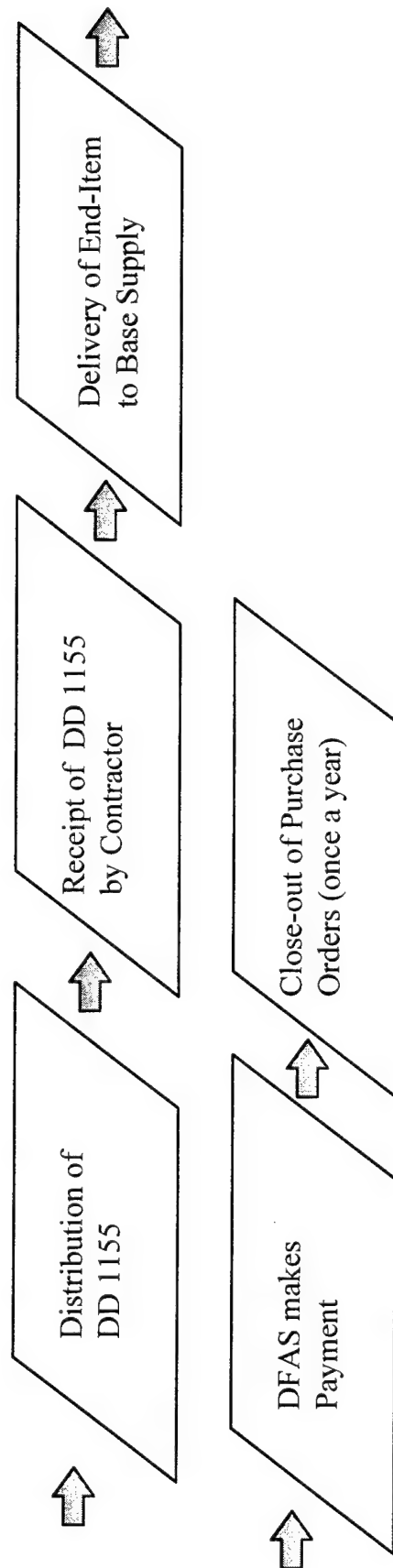
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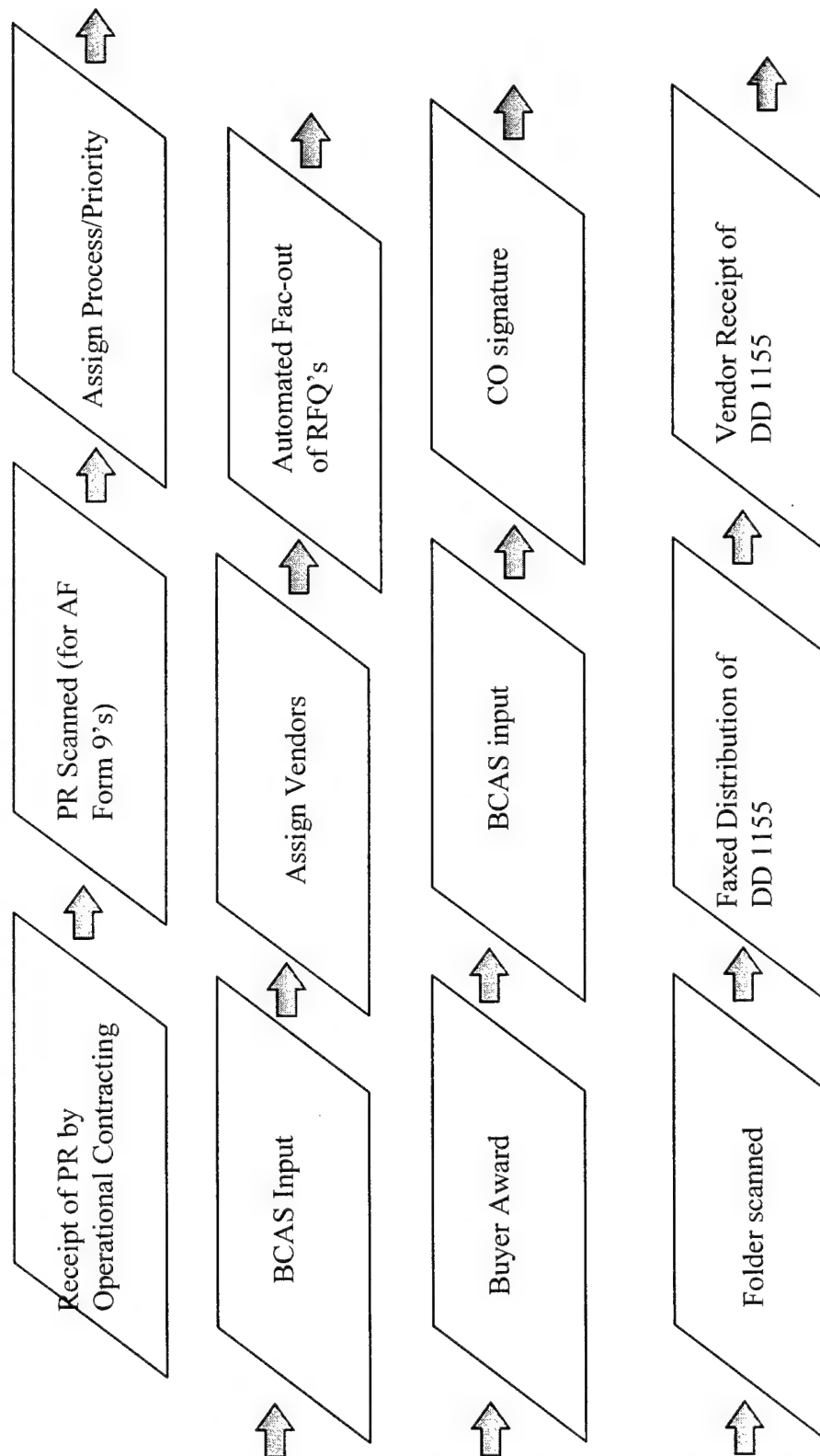
# Process Flow for GOCCESS/COCESS- Typical Office



# Process Flow for GOCES/COCES - Typical Office (Continued)

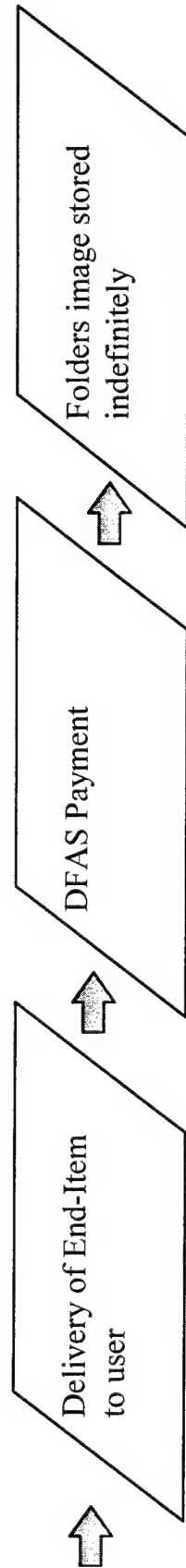


# Process Flow BICEP - Brooks AFB



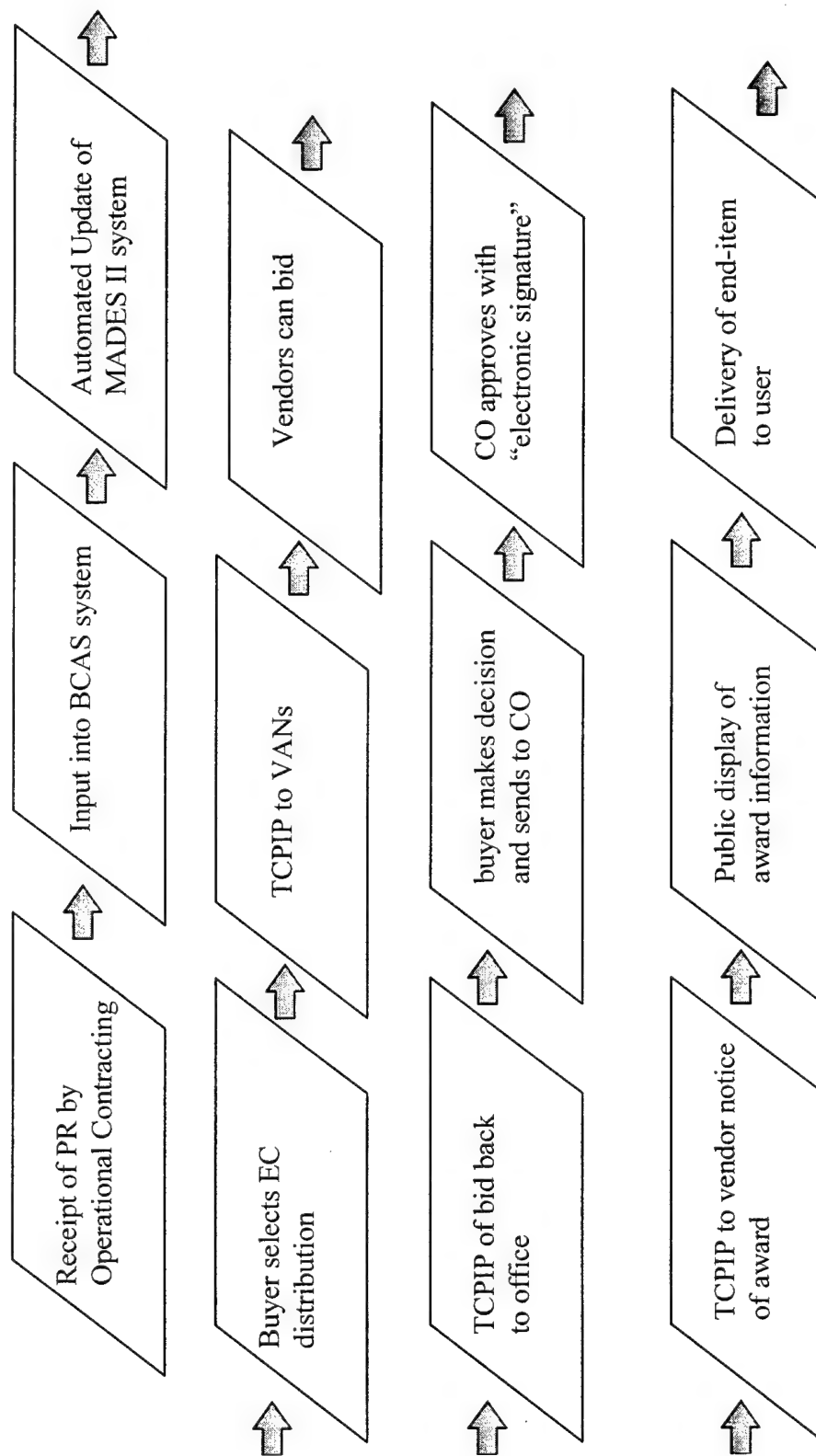
# Process Flow BICEP - Brooks AFB

## (Continued)

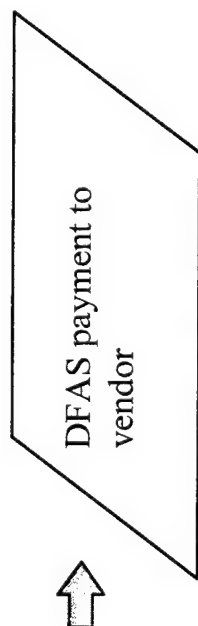




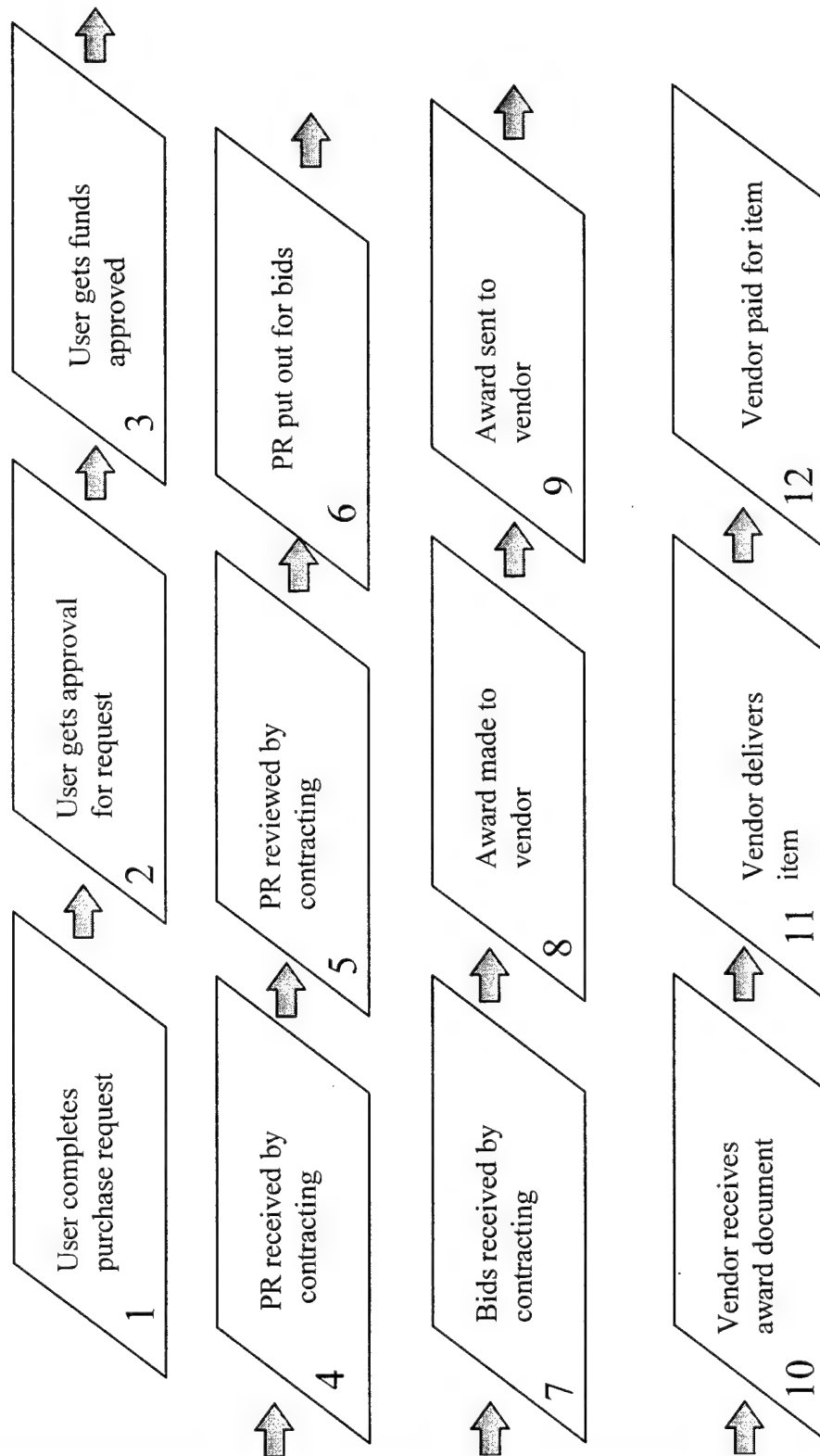
# Process Flow EC/EDI - Typical Office



# Process Flow EC/EDI - Typical Office (Continued)



# Theorized Common Process Flow



# Matrix of Processes

	1	2	3	4	5	6	7	8	9	10	11	12
Management Info Sys	X	X	X	X		X	X	X	X	X		
Alt Means of Procurement						X	X	X	X			
Buyable Purchase Rqsts					X							
Customer Access to Info				X	X	X	X	X	X	X	X	X
Funding Issues			X									X
Accelerated Coords		X	X									
Purchase off-the-shelf	X				X							
Use of Socio-economic					X	X						
Regulatory												

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### Vita

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His first assignment was at Brooks AFB as a Contracting Officer, Small Purchase Team Leader and BOS Team Leader - Construction. In May 1995, he entered the School of Logistics and Acquisition Management, Air Force Institute of Technology.

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**AFIT RESEARCH ASSESSMENT**

The purpose of this questionnaire is to determine the potential for current and future applications of AFIT thesis research. **Please return completed questionnaire to:** AIR FORCE INSTITUTE OF TECHNOLOGY/LAC, 2950 P STREET, WRIGHT-PATTERSON AFB OH 45433-7765. Your response is **important**. Thank you.

1. Did this research contribute to a current research project?      a. Yes      b. No
2. Do you believe this research topic is significant enough that it would have been researched (or contracted) by your organization or another agency if AFIT had not researched it?  
a. Yes      b. No
3. **Please estimate** what this research would have cost in terms of manpower and dollars if it had been accomplished under contract or if it had been done in-house.

Man Years \_\_\_\_\_ \$ \_\_\_\_\_

4. Whether or not you were able to establish an equivalent value for this research (in Question 3), what is your estimate of its significance?  
a. Highly Significant      b. Significant      c. Slightly Significant      d. Of No Significance

5. Comments (Please feel free to use a separate sheet for more detailed answers and include it with this form):

\_\_\_\_\_  
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